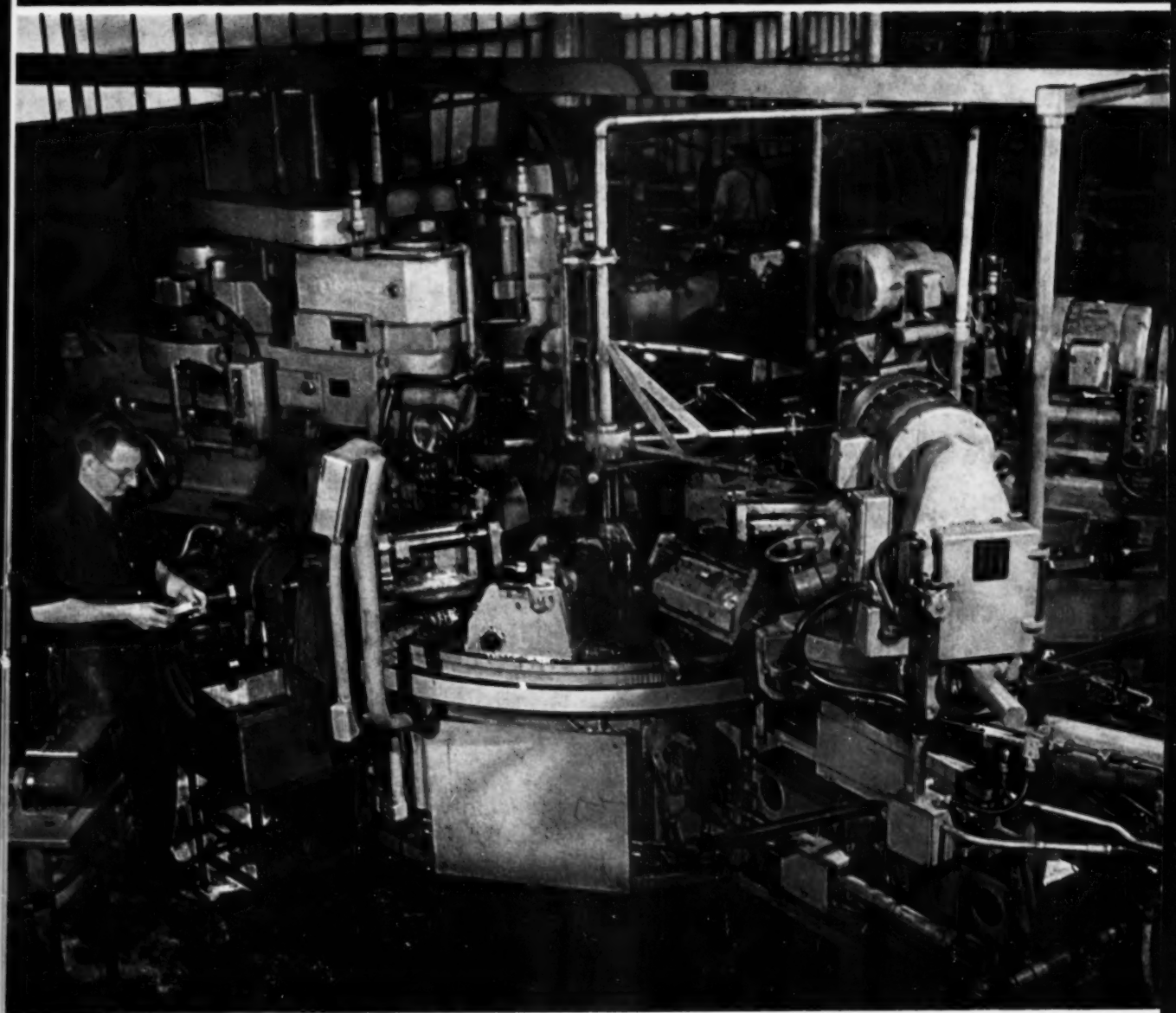
American Machinist

AUGUST 24, 1959 75¢

McGRAW-HILL MAGAZINE OF METALWORKING PRODUCTION

Europe's Mushrooming Auto Industry

SPECIAL REPORT, page 93



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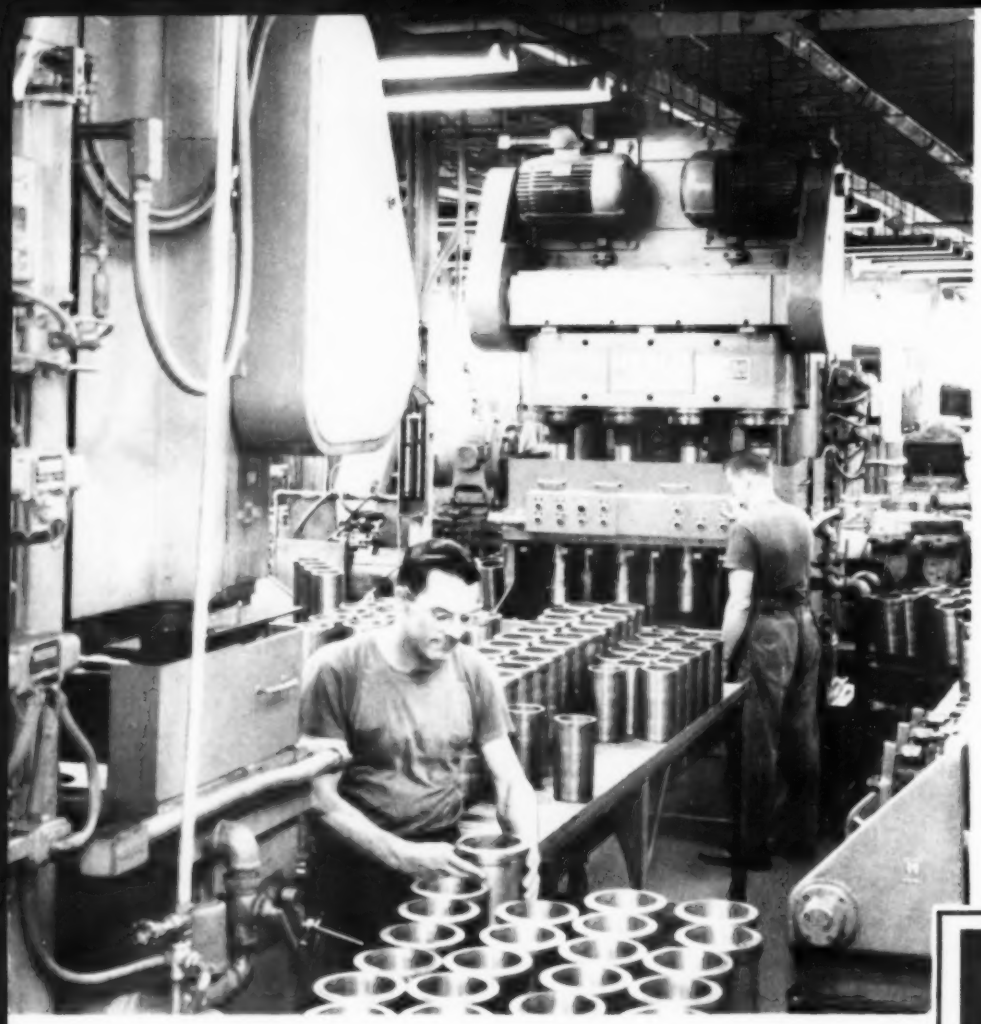

Two Heald Model S Bore Matics installed in diesel engine plant for rough and finish boring cast iron cylinder liners. Unit in foreground performs the roughing operation, with capacity of up to ¼" of stock removal on four parts at a time, followed by finish boring on identical machine at the right.

HEALD

KING-SIZE BORE-MATICS

rough and finish bore diesel cylinder liners FOUR AT A TIME

HEAVY-DUTY roughing and precision finish boring are the dual functions of the two Heald Model S Bore-Matics shown above. Installed in a large diesel engine plant, these huge, 10,000-pound machines are identical except for tooling – each handling four large cast iron cylinder liners at a time.

One machine, used for the roughing operation, is capable of removing a full quarter inch of stock – the other is used for finish boring to close tolerances for size and concentricity. Each four-station machine is equipped with a hydraulic clamping fixture and operates on a fully automatic push-button-controlled cycle. Total cycle time is 266 seconds on the roughing operation, with a net production of approximately 40 parts per hour.

These big vertical Bore-Matics are further evidence of Heald's ability to handle all phases of a machining operation from rough casting to finished part on any size work.

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American Machinist
McGRAW-HILL MAGAZINE OF METALWORKING PRODUCTION

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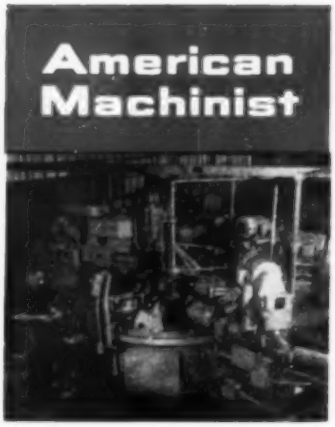
METALWORKING REPORT

SIGNIFICANT CURRENT DEVELOPMENT IN TOOLING AND PRODUCTION PROCESSES



COVER:

Low-volume automation is possible, but it isn't easy. General Electric's small steam turbine department ran into plenty of complications; one being the fact that large quantities for that department are 150-300 turbine buckets at a time. These used to require six to eight machines and up to five weeks. The pictured mechanization at a single rotary table with multiple heads was possible only after all bucket shapes were standardized. See page 82 for more details.

CUTTING

Chemical Tolerancing

Chemical etching process called Chem-Tol is reported to bring an entire piece of sheet-metal stock to tolerances of ± 0.001 in. Best tolerances previously available on sheet metal were ±0.003 in., and these required special mill runs. Chem-Tol can also be used on parts of any configuration before or after forming, machining, or chemical milling.

U S Chemical Milling Corp., Calif, originator and developer of the process, is holding back details until patents are firmed up, except to say that there is no similarity between Chem-Tol and chemical-milling techniques. Best guess is that Chem-Tol is a thermally controlled chemical reaction which can etch several surfaces differentially by varying temperature of the solution contacting each surface. No masks are used.

Though very expensive at present, the process can be used profitably in applications such as steel skins on the B-70 and other Mach 3 aircraft, where reduction of a few thousandths in skin thickness could cut as much as a ton off total weight. Company hopes to develop assembly-line techniques to bring costs down to commercial levels.

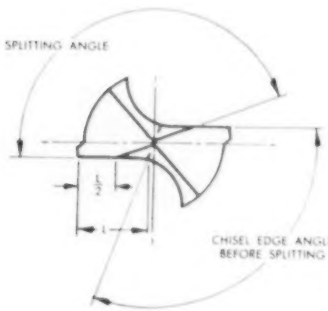
Modified Drill Point

A modified split-point drill is gaining popularity for superalloys (see drawing). With increased strength of the central cutting edges it reduces chipping tendencies. This makes it possible to use the super high-speed steels for the drill. (These steels have better cutting properties but chip badly unless the cutting edges are well supported.)

A further advantage is that the point is more pronounced on the modified split point. Conventional split points are almost flat and the drill tends to wander off center.

To make the new point, the secondary cutting edges created by the splitting operation are rotated toward the main cutting edges, so the intersections occur at about the midpoint of the original cutting lips. The intersections of the cutting edges are more blunt and the relief angle behind the central cutting edges is determined more by the drill point relief than by the point angle.

The new point has been used for some time by National Twist Drill and Tool Co and is also available from other drill producers. (For a more detailed discussion of the new point, circle No. 50 on the Reader Service Card.)



Cut Moly Faster

Higher cutting speeds, higher feed rates are the rule, and have been for some time. But even as recently as three years ago this rule was not thought to apply to molybdenum. According to the latest field data gathered by Climax Molybdenum, the rule applies to moly, too, and with a vengeance. In a definitive series of articles three years ago (AM—Sept 24 '56, p 152) it was suggested that 25-50 sfpm and 0.002 ipr were reasonable figures. Now, according to best practice, surface speeds may go up to 400-600 sfpm and feed rates to 0.005-0.010 ipr. The increase is by a factor of at least 10:1.

Machining Teflon

If you start with a good grade of Teflon stock and know something about the properties of this slippery, waxy material, you should be able to machine parts to within 0.001 in., sometimes within 0.0005 in. Tri-Point Plastics, Inc, Albertson, Long Island, NY, has developed special extrusion machines that produce high-grade tetrafluoroethylene stock, and specializes in the machining of precision Teflon parts.

High-speed cutting tools with extremely sharp cutting edges have been found best for this material. Forming tools should have a 15° to 20° top rake and a 10° to 15° front clearance angle. All tools, naturally, should permit good flow of cutting oil to the part. For case histories and further data see page 106.

FORMING

"Hot Die" Press Forging

Better and more economical forgings will be possible with a technique developed by Armour Research Foundation for the Air Materiel Command. Press forging is limited by the relatively cold die. A hot blank forged by a cold die loses heat so quickly that within seconds thin sections and complete filling of deep die cavities are rendered difficult to obtain. Also removal of the

part from the cold die requires exaggerated draft.

To overcome these deficiencies, the researchers found that Inconel 713C would not deform if heated to 1600F, but that they had to develop a new casting system. The alloy is not susceptible to conventional diesinking or foundry practices. Therefore, a new foundry molding system was developed. A moldable graphite mixture is employed instead of sand, to produce a gas-free strong die with a surface so smooth that subsequent finishing is not required.

The Inconel 713C dies forged a variety of stainless and other heat-resisting alloys with thin sections and reduced draft. Dimensions of the forgings are very close to final ones, thereby minimizing machining. It is expected, too, that the hot-die forging technique will reduce the number of die impressions in a sequence to produce a part.

Big Hammer

A closed-impression die forging hammer, capable of producing forgings of a size never before possible, has been installed by the Ladish Co, Milwaukee. The 125,000 MKG (meter-kilogram) counterblow hammer surpasses the 80,000 MKG machine brought from Germany in 1950 and installed in the Ladish plant. The largest hammer operating in Europe is rated at 40,000 MKG.

The new hammer is capable of producing forgings weighing over 22,000 lbs. Designed, constructed and installed by Ladish personnel, the machine has a 96-in. vertical stroke between twin rams. Over 1,000,000 ft-lb of energy is developed, and a force of over 100,000 tons is exerted at the moment of impact. Octagonal or round closed dies up to 96 in. and rectangular dies up to 72 in. wide by 200 in. long can be put into the hammer.

The counterblow principle, in which two opposing rams are synchronized to strike a forging blow, permits energy release far beyond that possible in a single-action hammer. The principle was developed in Germany in 1930.

HEAT TREATING

Spall-Away Coatings

Ceramic enamel coatings are being used at Norair (formerly Northrup Aircraft), Hawthorne, Calif, to prevent oxidation and embrittlement of 17-7 PH and other heat-resistant alloys during heat treating. Even when

OUTLOOK:

Strike-caused steel shortages are beginning to have an effect on overall metalworking production. As a result, output has dropped slightly from the all-peacetime peak (185 on the American Machinist Index) reached last month. **(See p73).**

treated under atmosphere some of these alloys become quite brittle. The coatings, which can be dipped, sprayed, or brushed on, form a complex silicate or phosphate glass when heated, then spall away as the part cools, leaving a bright, scale-free surface.

Earlier techniques made use of aluminum-silicone paints, but these required long drying periods, careful handling, and elaborate stripping procedures. A further improvement was the use of a water-soluble glass that was sprayed on. This coating had to be removed with a caustic-soda solution.

Norair's ceramic enamels are also used on 17-4, Type 321 and other stainless steels. Coatings for titanium and other heat-resistant alloys are in development.

INSPECTION

Versatile Balancer

Rotating parts from a 20-lb pulley to a 40,000-lb propeller can be dynamically balanced on a machine just installed at the Avondale Marine Ways, Inc, New Orleans. The machine, reported the first of its kind, is the joint development of Stewart-Warner Corp and Merrill Engineering Labs.

The Model 708 machine detects unbalance by resonance in a vibrating spring system, to define and locate the amount of unbalance electronically. Workpieces from 7 in. to 40 ft long can be accepted; likewise shaft diameters from ¼ to 24 in. A friction-belt drive system reduces setup time.

Lab Offers Optics

Aircraft companies are branching out their services to others. The San Diego plant of Convair Div., General Dynamics, has an electronics-engineering sub-group that is now equipped to turn out optical instruments for special tooling purposes. Romuald Anthony is design specialist in charge of the group. Lens and mirrors can be made to an accuracy of 1/20 wavelength of light over a 12 in. dia. Prism angles can be fabricated to one second of arc.

Infra-red instrumentation is likewise a specialty of the group. Mr Anthony says he hopes soon to be using an infra-red system as a welding monitor—to determine characteristics of welds and castings. The group is also grinding metals to be used as standards for inspection.

WELDING

Really Portable Spotwelder

The term portable spotwelder has always been something of a misnomer, but here's a spotwelding outfit that can actually be carried.

The operator holds two insulated, non-consumable electrodes, one in each hand, and uses them as prods. The electrodes are connected by flexible cables to the transformer, and a normally-open switch is located in one of the handles.

To make a weld, the operator places the prods at the desired points, switches on the current, and makes two simultaneous resistance welds, without heavy pressure and without handling any heavy equipment.

The process was developed in England by Triangle Products Ltd, which claims that the free choice of welding position and the light weight carried make access to difficult work easier. The operation is said to be safe, as the electrode holder may be put down anywhere.

ASSEMBLY

Mass Production at 25 Millionths

Interchangeability of parts is the rule for mass-produced products, but it is still unusual to see real interchangeability in components built to tolerances as close as 25 millionths. Dalmo-Victor of Belmont, Calif, manages this kind of precision for servo valves and other hydraulic devices. One of the many problems is removing small burrs from cross-holes in servo sleeves, which is handled on a liquid honing machine. The company applies standard machines for many jobs, then uses special home-built equipment for other close-

tolerance operations. Parts are precision machined, then closely inspected; some with air gages. Working units can be interchangeably assembled because all fabricating is aimed at closer tolerances than normal. See p 79.

FINISHING

Aluminum Skin Protector

Developed by Rohr Aircraft Corp, Riverside, Calif, a spray-on coating forms a hard, transparent, colorless film that is indistinguishable from the metal itself. It is said to be so hard that it can go through the drop hammers, even on deep draws, and prevents galling and seizing. Color may be added if desired.

Unprotected skins of the alloys used at Rohr are so sensitive to abrasion that even the drag of an air hose may gouge them. But with the protection of the new coating, assemblers can work faster without worrying about handling damage. Additional savings are realized in the reduction of time for polishing out finished assemblies. The risk of chips working under the usual protective coatings during drilling or routing is eliminated, and the areas around countersinks are cleaner, freer of scratches and swirls that must be polished out.

A further advantage is that the coating is easily removed with mild soap and water, yet a drill motor can be dragged across it without injuring the metal beneath. Still in the development stage, the coating is not commercially available at the present time.

Dustless Dry Polishing

A completely dustless polishing method developed at the Tractor Works, Orasul Stalin, Rumania, uses a rotating cast-iron disk whose edge is shaped to conform to the work profile, and which carries 16 v at 2000 amp. Contact between the work and the wheel closes the circuit, and the resistance generates sufficient heat to melt the work surface and produce a polishing effect. A pneumatic system holds the work and wheel in close contact. The process is claimed to reduce processing time by 50% and increase productivity 600 to 800%.

New titanium process

Ductile titanium now can be made by an electrolytic process newly developed by a team of Norton Company research men. After seven years of work, Dr Guy Ervin, Jr, Dr H F G Velty, and Malcolm E Washburn believe they have a process which may make titanium metal less expensive to produce. Titanium production during 1958 was only 4500 tons; the present price of bar and sheet stock is about $9 a pound.

Starting point for the new process is titanium carbide, which forms the anode of the electrolytic cell. During electrolysis, the titanium is separated from its carbide and adheres to the cathode as tiny crystals of pure metal. These crystals can be melted and cast into ingots or fabricated into products by metal-powder techniques. Electrolysis takes place at 900 C in argon to prevent oxidation. Batches of up to 12 lb are being made.

MATERIALS HANDLING

Handling in Europe

Automation has arrived in a big way at the plants of Europe's automobile makers, as the story beginning on p 94 shows. So has materials handling. Here are a few examples of handling techniques that have been perfected in European auto plants:

- Turin, Italy: In a Fiat plant, warehousemen operate elevators that speed flow of about 75,000 different parts. These electrically controlled units move horizontally between storage racks, as well as vertically. System eliminates time-consuming transfer of parts.
- Birmingham, England: After testing in the Austin plant, car bodies and engines are automatically marshalled in a central area. A punched-card system selects them in proper sequence, starts them on their journey to the assembly building.
- Poissy, France: In the Simca plant, overhead "pipe tracks" carry steam, water, propane, acetylene, and oxygen to points in the plant where they are needed.
- Ruesselsheim, Germany: In the Opel plant here, more than 40 miles of conveyors and assembly lines are supplemented by pneumatic, hydraulic, and electronic handling devices that automate production lines.

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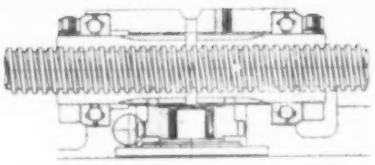

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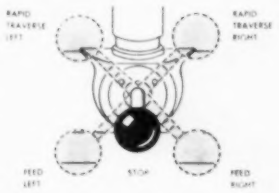

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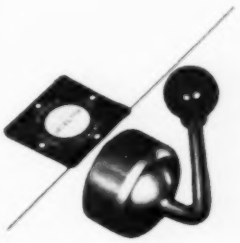

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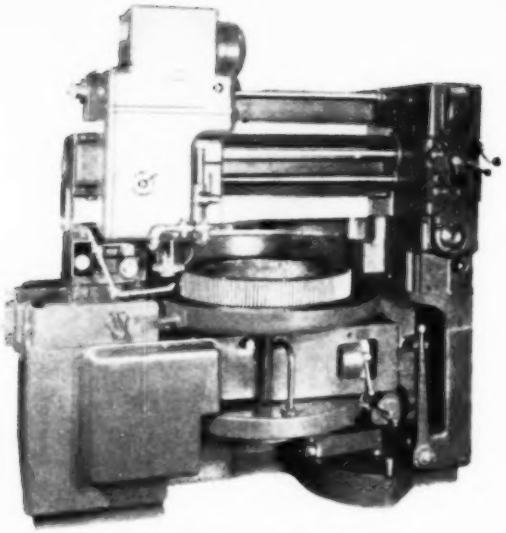
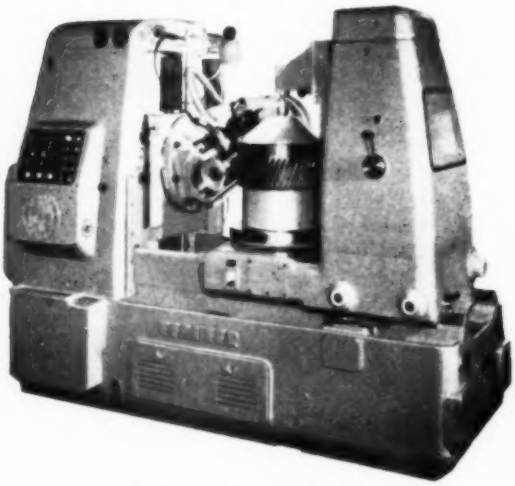
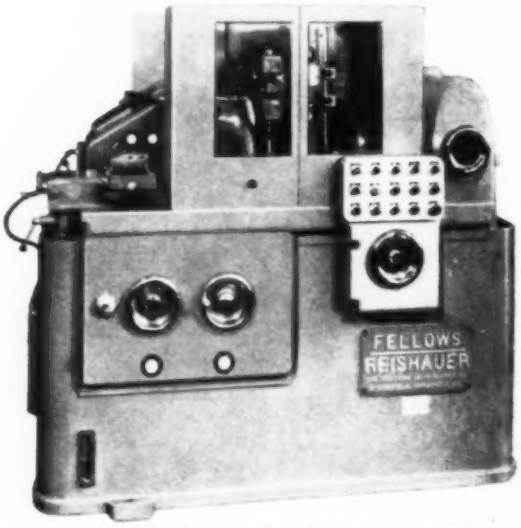


Fellows Gear Shapers... up to 120" capacity



Pfauter Gear Hobbers... up to 120" capacity



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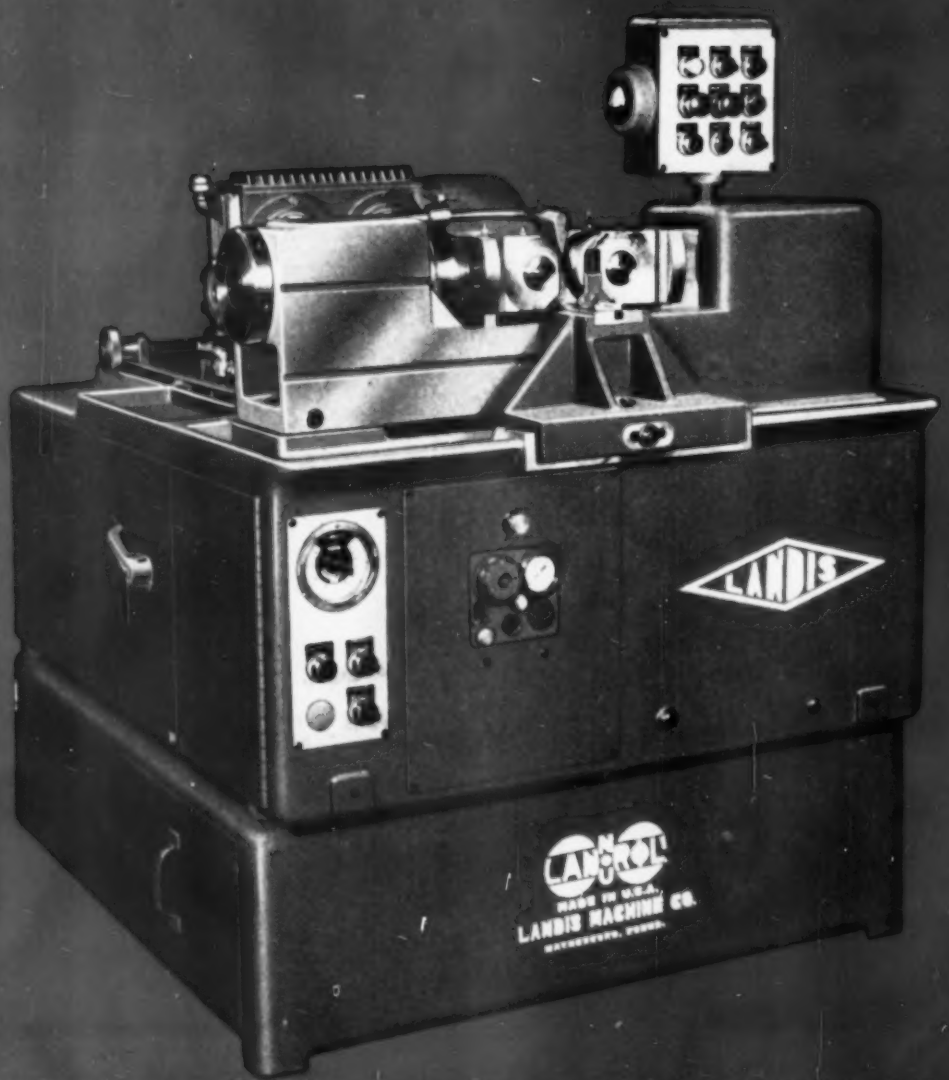
WHATEVER YOU NEED for modern gear productivity, Fellows has the equipment to keep you in the competition! In addition to Gear Shapers, and all other Fellows equipment from cutters to inspection instruments, Fellows now sells the No. 12 Fellows-Reishauer Gear Grinding Machine and the complete line of world-famous Pfauter Gear Hobbers! Fellows Gear Shapers and Pfauter Gear Hobbers provide outstanding accuracy and high production speeds, on short runs as well as long runs, for a wide range of gears up to 120" P.D. On all but the larger units, a wide range of attachments is available for semi-automatic or fully automatic operation. Runout tolerances measured in tenths, produced at production line speeds, are the special province of the No. 12 Fellows-Reishauer Gear Grinding Machine. Simple, fast set-up permits economical grinding of single gears as well as long runs in sizes up to 12" O.D. Ask your Fellows Representative about the complete line of gear production and inspection equipment. Just write or call any office of The Fellows Gear Shaper Company, 78 River Street, Springfield, Vermont. Branch Offices: 1048 N. Woodward Ave., Royal Oak, Michigan.; 150 W. Pleasant Ave., Maywood, New Jersey; 5835 W. North Ave., Chicago 39, Illinois; 6214 W. Manchester Ave., Los Angeles 45, California.

FELLOWS GEAR PRODUCTION EQUIPMENT

THE PRECISION LINE

FROM THE WORLD'S LARGEST

A NEW LOW COST THREAD ROLLING MACHINE



LANDIS Research has now developed the LAN-NU-ROL Thread Rolling Machine—designed to meet the requirements for jobbing or high production thread rolling operations.

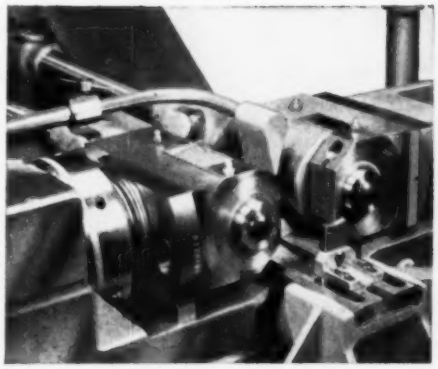
Low cost and economical to operate, the cylindrical-die LAN-NU-ROL Machine is a perfect complement to the larger, heavy-duty LANHYROL Thread Rolling Machine that has been producing unequalled results for several years. The LAN-NU-ROL's design concept is formed on the bases of simplicity, rigidity, power, accuracy, versatility, low first cost, low die cost, and uncomplicated set-up and service.

The LAN-NU-ROL Thread Rolling Machine produces strong, accurate threads of excellent finish by the chipless cold-forming process. It is ideally suited for Thru-Feed Rolling and a full complement of automatic feeding is available for threading by this method. Although intended primarily for hand-loaded Infeed Rolling operations, automatic feeds can be supplied for Infeed Rolling wherever practical. The LAN-NU-ROL will thread all diameters up to 2" by Infeed Rolling and up to 1" by Thru-Feed Rolling, depending on workpiece material and thread specifications. It will produce left- and right-hand threads of all types (except square), including UNC, UNF, Acme, Worm, and many special forms.

For additional information—please send specifications and ask for Bulletin E-101.

LANDIS *Machine* COMPANY
WAYNESBORO • PENNSYLVANIA

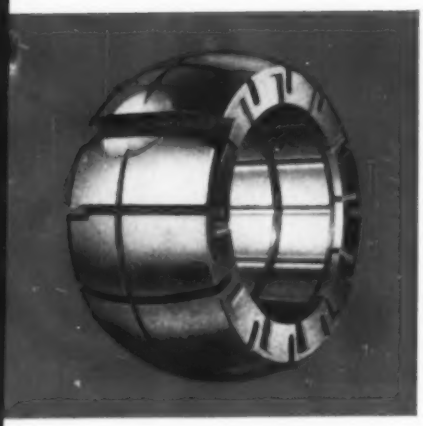
the world's largest manufacturer of THREADING EQUIPMENT



DESIGN FEATURES

- **WIDE DIAMETRICAL RANGE** —up to 2" by Infeed Rolling and 1" by Thru-Feed Rolling, depending on workpiece material and thread specifications.
- **TWO-DIE DESIGN** —minimizes die cost, set-up time and auxiliary equipment.
- **PNEUMATICALLY-OPERATED** —hydraulically-operated (optional) . . . allows a high infeed cycling rate . . . up to 60 per minute; can be operated from plant air supply.
- **MANUAL, SEMI-AUTOMATIC AND AUTOMATIC DIE CYCLING**
- **AUTOMATIC FEEDING EQUIPMENT**
- **TOGGLE-OPERATED INFEED SYSTEM** —develops brute rolling pressure with maximum thermal stability and minimizes stress deflections.
- **INFINITELY VARIABLE SPINDLE SPEEDS**— 166 to 500 RPM.
- **INCLINABLE ROLL HOLDERS**
- **SIMPLE, HIGHLY-EFFICIENT WORM-GEAR DRIVE TRANSMISSION**
- **INTERCHANGEABLE TOOLING SYSTEM**
- **EASY SET-UP AND SERVICING**

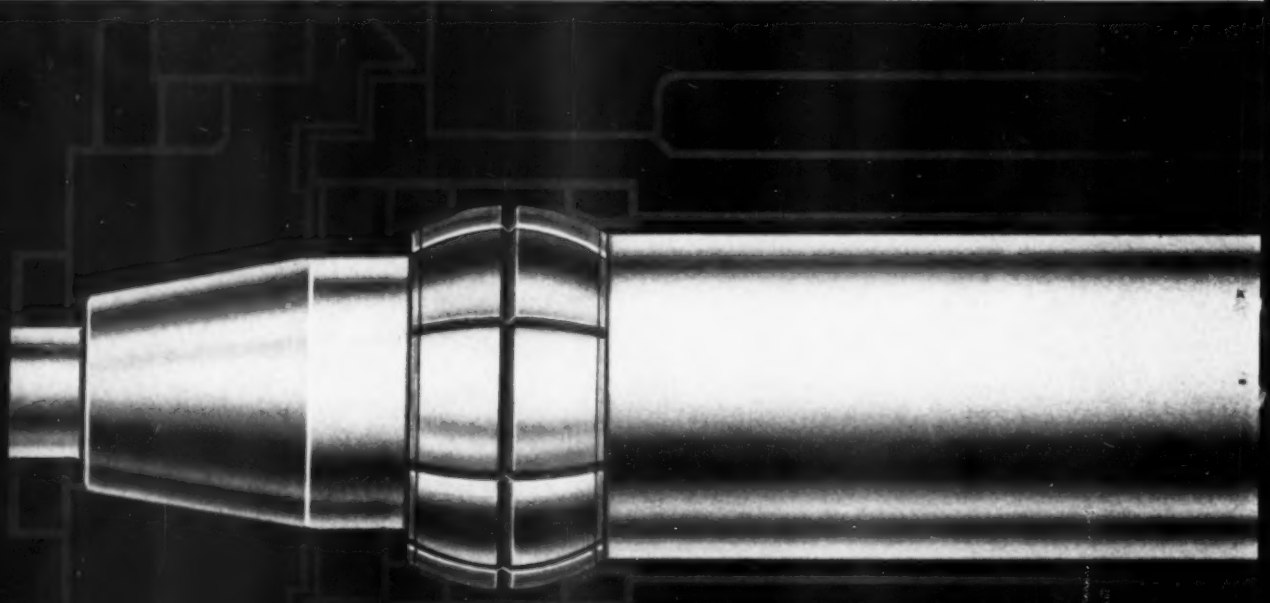
Microsphere bearings prove their on more than 15,000 Landis grinders



SAVES TIME . . . close running clearance gives quick positive spark-out and faster grinding cycles.

TROUBLE-FREE OPERATION . . . simple, one-piece bearing.

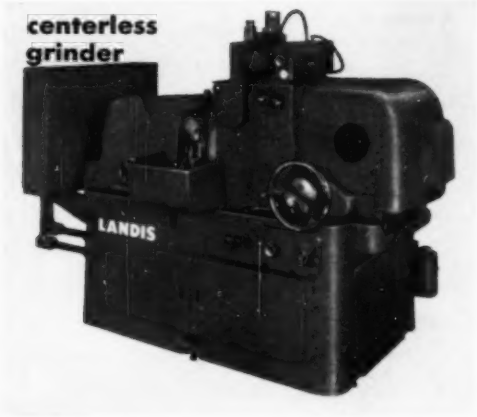
INCREASED STOCK REMOVAL . . . heavy duty rigidized spindle permits heavier cuts to precision tolerances and fine finishes.



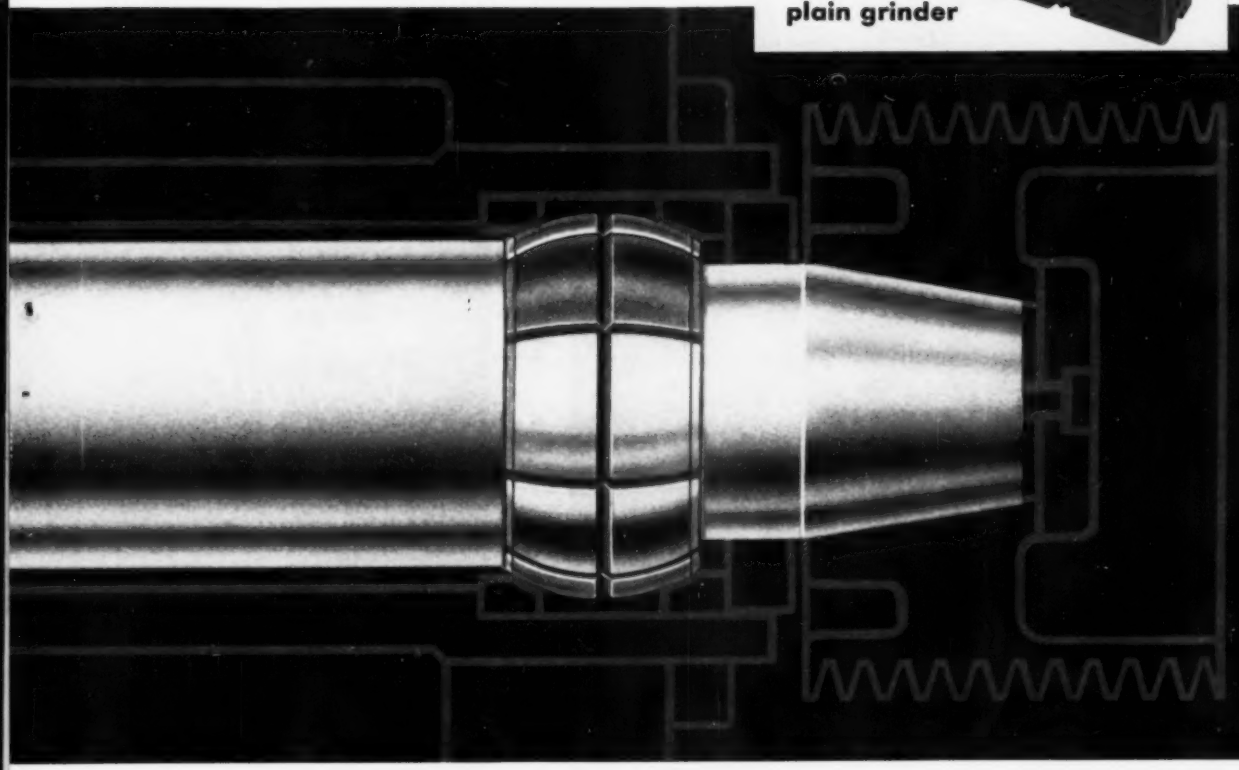
Cross section of a typical Landis rigidized wheel spindle and Microsphere bearings.

LANDIS TOOL COMPANY / WAYNESBORO, PENNSYLVANIA

production advantages

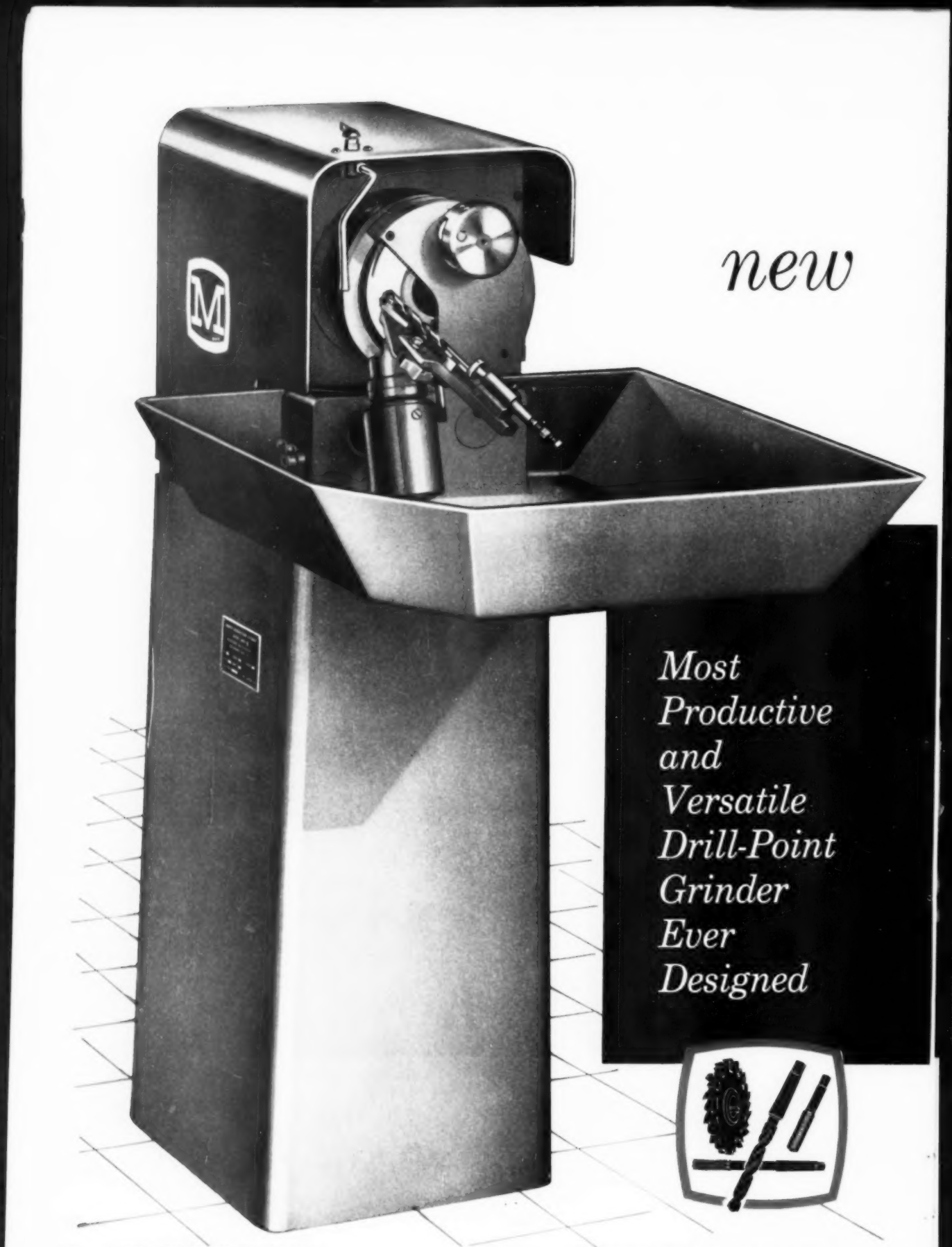


Exclusive one-piece Microsphere bearings are used on all Landis plain, universal, centerless, roll and special purpose grinders.



LANDIS

precision grinders


new
Most Productive and Versatile Drill-Point Grinder Ever Designed

MORSE

Production

DRILL-POINT GRINDER

Now . . . you can accurately grind points on a profitable, high-production basis.

This new machine, conceived and built by Morse . . . has been thoroughly job-proved in the Morse plant. In fact, this one compact unit, with its attachments, will grind the following points . . .

CONVENTIONAL

HELI-CENTRIC

and **SPLIT POINT...**
(CRANKSHAFT)

on a high-precision, high-production basis. No other machine can match this performance.

For complete details, write for new illustrated bulletin.

MORSE TWIST DRILL & MACHINE CO., NEW BEDFORD, MASS.

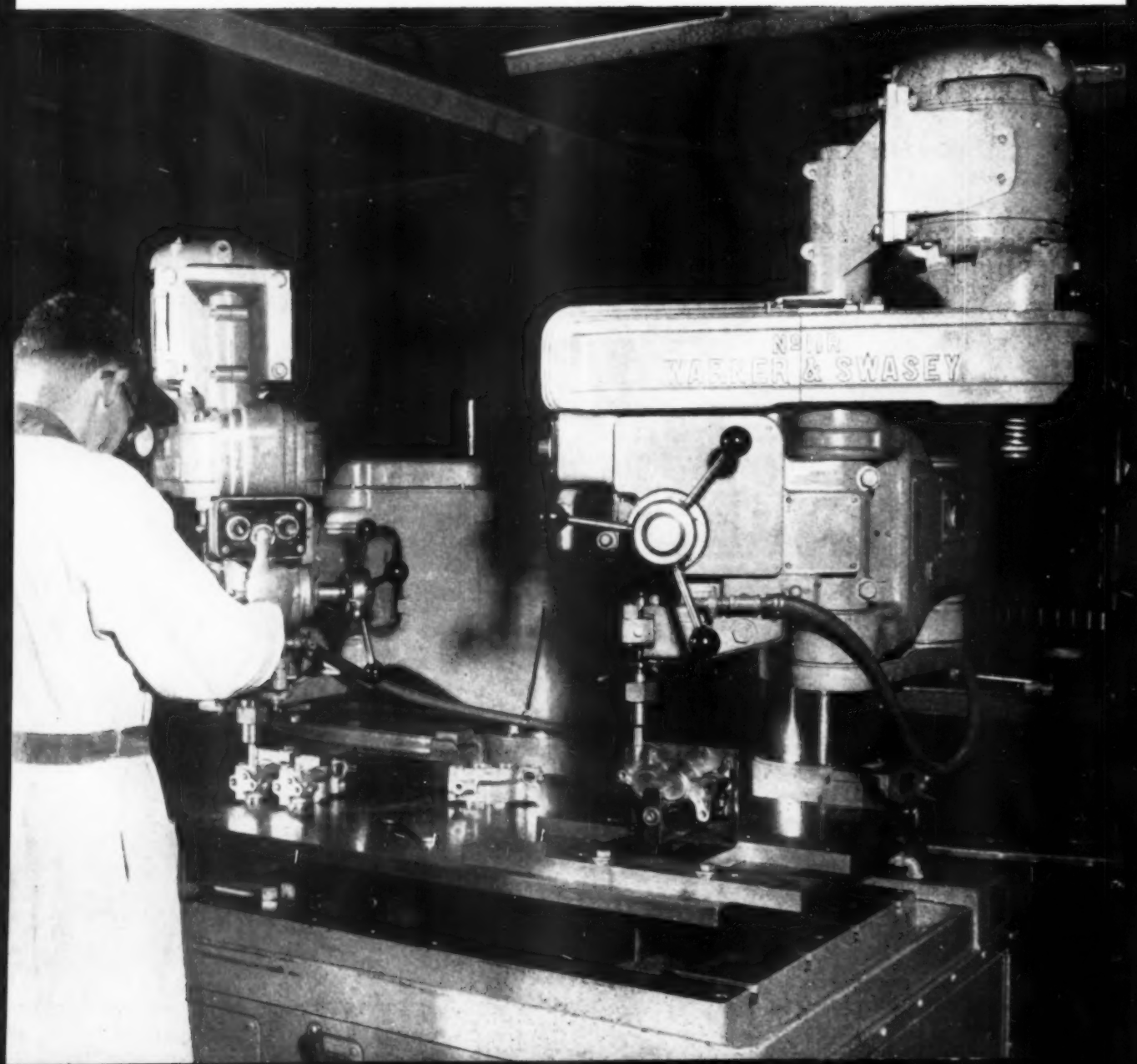
Warehouses in New York, Chicago, Detroit, Dallas, San Francisco.

VNI *A division of Van Norman Industries, Inc.*

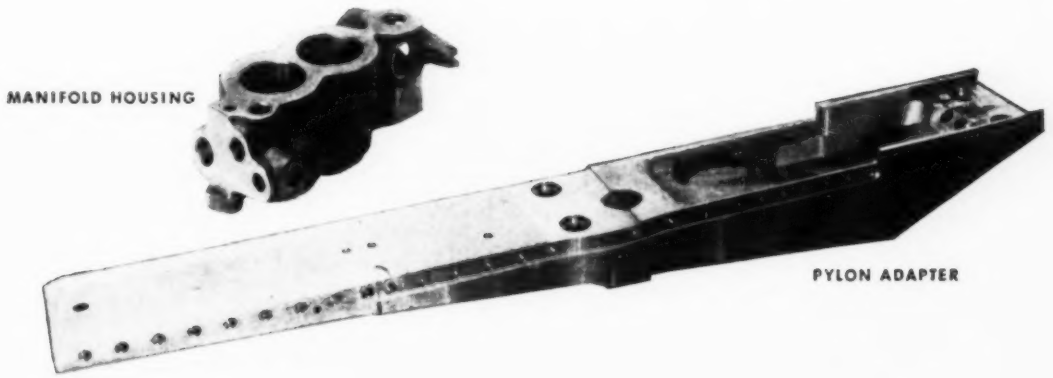
MORSE *means* "THE MOST" *in Cutting Tools*

At C. L. Gougler Machine Co.

Warner & Swasey Precision production jobs to rigid aircraft



Radial Tapper easily handles specifications...eliminates scrap loss



Dual heads of their new Warner & Swasey 11 RD Precision Tapping and Threading Machine permit Gougler to tap holes at different levels—of different size or pitch—in the same workpiece without interrupting production flow. They report that blind holes and depth accuracy no longer present a tapping problem in their modern Kent, Ohio, contract plant.

Two interesting jobs are handled at Gougler. First is the Pylon Adapter (shown above) that's mounted under the wing of a fighter plane for ejection of fuel tanks. It's a 30-inch long aluminum forging that has had 30 costly machining hours before it reaches the Warner & Swasey Tapper. As it would cost over $300 to replace—scrap due to imperfect tapping would be extremely costly.

Lots consist of 197 sets—each having a right and left-hand part. Every piece has 35 blind holes tapped 5/16"-16, Class 3, 7/16" deep.

The second job—produced in 7,000-piece lots—is a Manifold Housing for a bomb and tank ejector. It's a tough SAE 4340 steel forging of 39-42 Rockwell. Four holes are tapped on the Warner & Swasey: three are 1/2"-20, Class 3; one is 5/8"-18, Class 3.

Production time per piece averaged 30 minutes when this job was rough-tapped on a drill press and finished by hand. Now, it takes only 4 minutes on the Warner & Swasey. Formerly, 4 pieces per 100 were scrapped—with the Warner & Swasey, not one piece has been scrapped.

If you need extreme threading accuracy on production jobs, then see your Warner & Swasey Field Representative. He will gladly discuss how to improve all your tapping operations—produce a better product. Of course—no obligation.

YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS . . .

WITH A WARNER & SWASEY

WARNER & SWASEY
Cleveland
PRECISION MACHINERY SINCE 1880

◄ CIRCLE 165 READER SERVICE CARD

CIRCLE 166 READER SERVICE CARD

Republic's **CENTURY SERIES** provides..

High Strength, Stress Relieved, Cold Finished Steel Bars Best Suited To Your Requirements

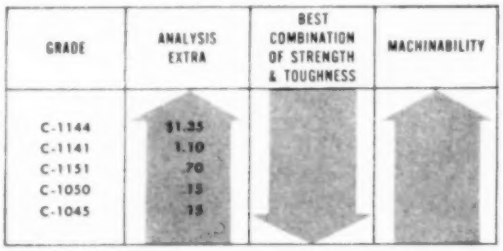
Now, you can select from a family of five grades of steel, a specially processed, cold finished, stress relieved bar product to meet the specific requirements of your steel parts production calling for high strength with varying degrees of machinability.

Each grade in Republic's CENTURY SERIES – C-1144, C-1141, C-1151, C-1050, and C-1045 – provides a *minimum yield strength of 100,000 psi.* Machinability ratings for the various grades are presented in descending order – from C-1144 for best machinability, to C-1045 where maximum machinability is not required.

Republic's over-all policy has always been to suggest the least expensive grade of steel that will adequately meet the mechanical requirements of the application and the degree of machinability required.

The CENTURY SERIES makes it possible to achieve considerable savings by selecting the grade best suited to a specific requirement. For example, C-1144 would be the proper choice for a part requiring high strength with maximum machinability. A lower sulphur grade, such as C-1141 or C-1151, can be considered where maximum machinability is not required. If machinability is a minor factor, C-1050 or C-1045 may be considered.

As sulphur decreases, toughness and resistance to shock increase. Therefore, it is frequently possible to obtain a *better strength toughness ratio at lower cost* by using one of the less expensive, lower sulphur steels as indicated on the chart.



Which grade is best for your production? Republic offers the services of expert metallurgists – field, mill, and laboratory – also machining specialists to work directly with your personnel in selection, application, and processing of the right grade for your steel parts production.

FREE BOOK provides the basic facts you need to determine where Republic's CENTURY SERIES may help you save time and money in the production of steel parts. Mail the coupon for your copy.

CENTURY SERIES
C-1144
Distributor Shaft

CENTURY SERIES
C-1141
Hoist Support Shaft

CENTURY SERIES
C-1151
Electric Motor Shaft

CENTURY SERIES
C-1050
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CENTURY SERIES
C-1045
Shaft

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World's Widest Range of Standard Steels and Steel Products

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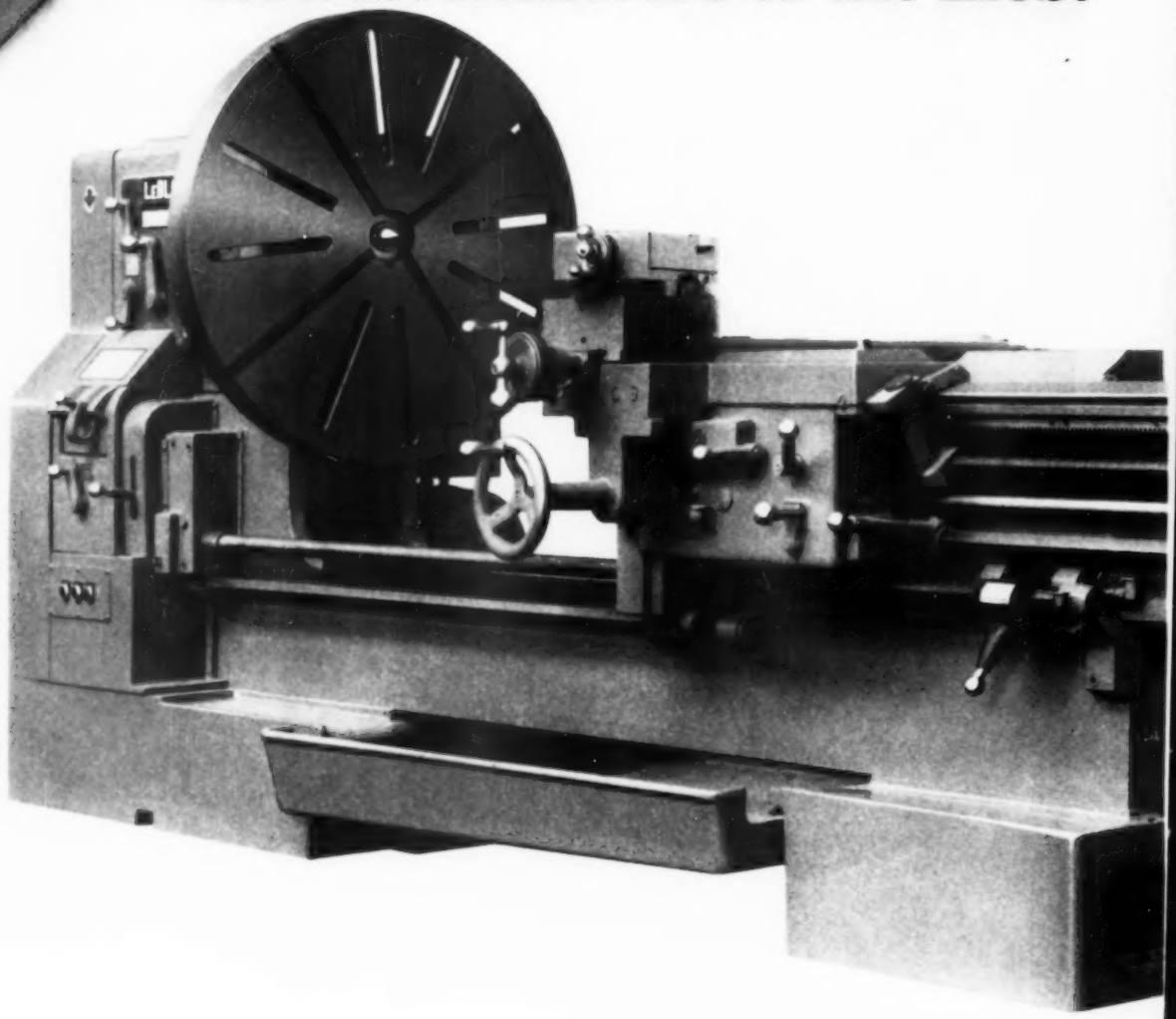
Newest members of the most



	REGALS		NEW!		HEAVY DUTIES		
	17"/28"	19"/28"	21"/39"	24"/39"	16"/38"	25"/50"	32"/60"
Swing over bed and carriage wings	17¾"	19¼"	22¼"	26"	20½"	30½"	34½"
Swing over gap	35"	36½"	48½"	52½"	46"	56"	61½"
Distance between centers, base, gap closed	30"	30"	48"	48"	72"	96"	84"
Distance between centers, base, gap open	50"	50"	84"	84"	120"	156"	144"
Horsepower, max.	5	5	10	10	20	50	60

Hollow Spindle Head available on all but 17" and 19" models.

versatile family in the world

21" and 24"/39" Regal

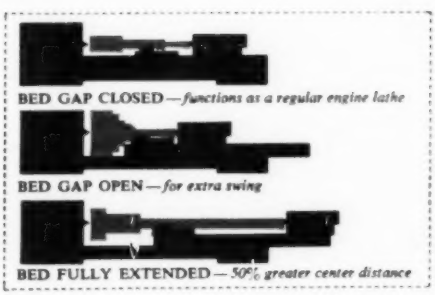
SLIDING BED GAP LATHES

Turning department in one machine!

The LeBlond Sliding Bed Gap Lathe is the most versatile turning machine ever built. With the bed closed it functions as a regular engine lathe. Its special bed *slides* open to form a gap of the proper opening to accept odd-shaped parts and large diameter jobs. Sliding the bed open also provides greater distance between centers. In addition, you get all the outstanding features, the stamina and dependability you expect in a LeBlond Lathe.

The two new members bring the family up to seven! Select the one that suits you best from the chart at left.

Call your LeBlond Distributor or write -



BED GAP CLOSED—*functions as a regular engine lathe*

BED GAP OPEN—*for extra swing*

BED FULLY EXTENDED—*50% greater center distance*

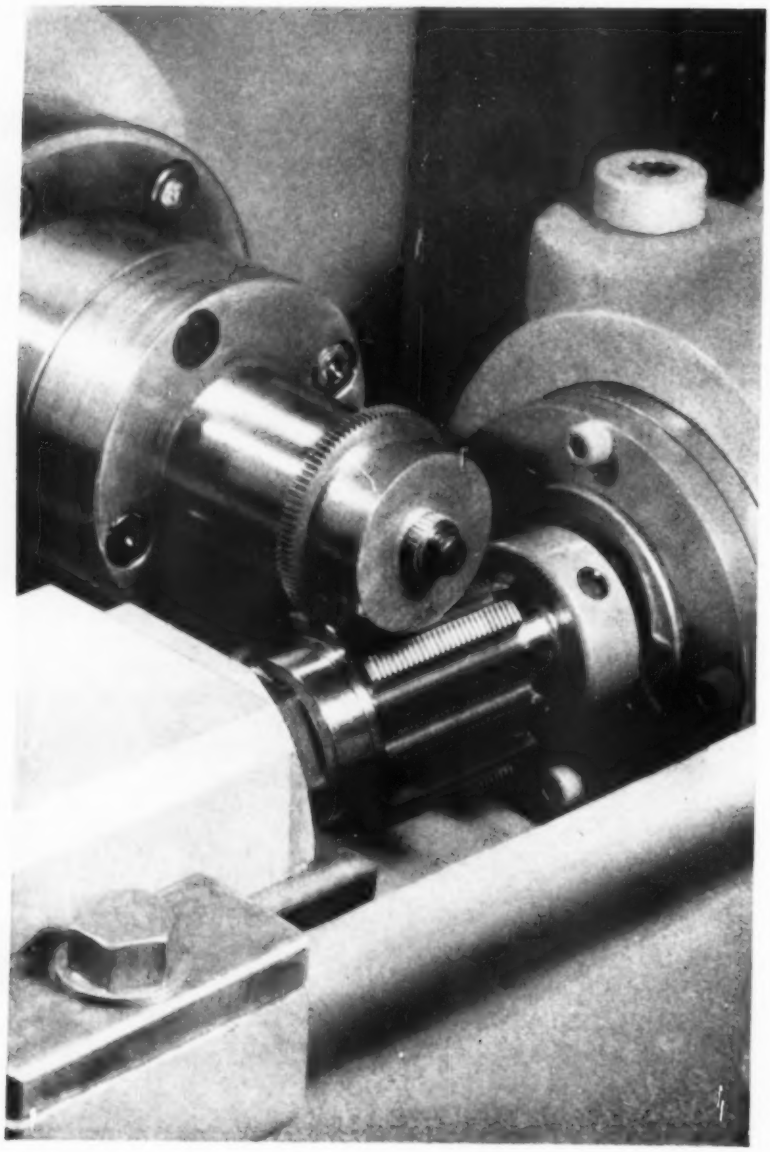
Here's how a LeBlond Sliding Bed Gap Lathe gives you extra capacity, versatility:

LEBLOND of Cincinnati

THE R. K. LeBLOND
MACHINE TOOL COMPANY
CINCINNATI, OHIO

New method of producing

AGMA Precision



Selection and segregation no longer necessary to insure precision-matched spur gear sets

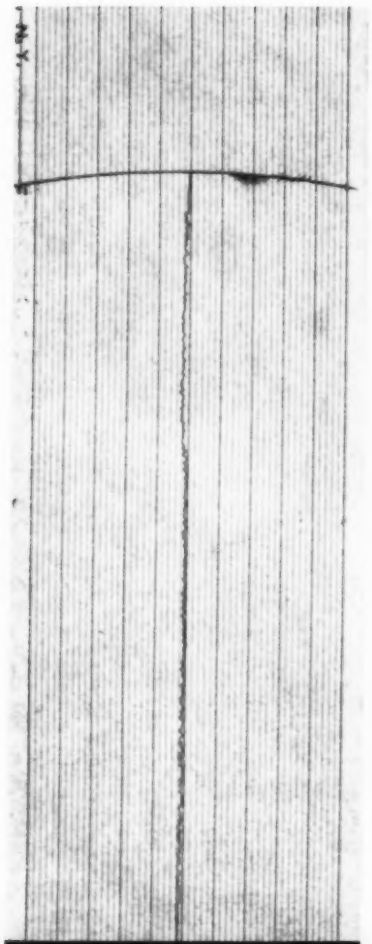
Selection and segregation — the process of producing more gears than you need in order to select a few that are within Precision Class 2 or Class 3 tolerances — is no longer necessary. And, these jobs at PIC Design Corporation, East Rockaway, L.I., New York, prove it.

In pioneering "Ultracision" accuracy for the missiles industry, Barber-Colman Company developed extensive machining and testing techniques now embodied in a new, low-cost hobbing machine — the No. 2½-4. For mass production of easily machinable parts which do not require such a high degree of accuracy, a high-speed version of this machine is available with a maximum hob speed of 2400 rpm.

Completely new hobbing machine

New concepts have been introduced into the Barber-Colman No. 2½-4 to bring you exceptional accuracy at a nominal cost. The No. 2½-4 is guaranteed to index accurately within 20 seconds of arc. This means that nonadjacent spacing error on a 2″ dia. gear would be only .0001″ due solely to the indexing error of the machine. When rigid tooling . . . accurate blanks . . . care in mounting the hob and work . . . Class AA hobs . . . and accurate hob-sharpening methods are used, it should be possible to hob AGMA Precision Class 2 and Class 3 gears without selection and segregation. Scrap and inspection time are reduced. And, in many

Class 3 Gears



Each line on tape represents .0001". This Precision Class 3 gear was obtained with only slightly more care than required for Class 2 gears.

cases, deeper savings can result from the elimination of finishing operations.

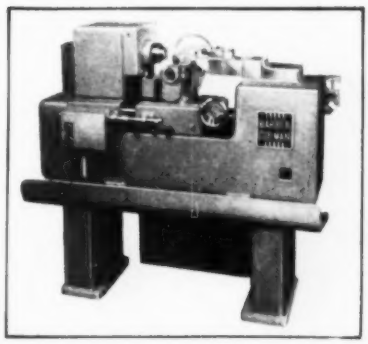
The accompanying PIC "true blue" gear tape shows the inspection record of a Precision Class 3 gear. On the production run, all gears had a total composite error of less than .0004". The gears have 96 teeth of 64 DP. The tape is made on a variable center-distance checking machine with a motor-driven master gear which rolls under preset pressure with the cut gear. After the work spindle adapter and the hob were trued within .0001", no further adjustments were necessary for hobbing gears of this accuracy.

The No. 2½-4 accommodates 3" dia. hobs, permitting maximum number of flutes for cutting accurate, smooth tooth profiles. Maximum work diameter is 2½" and length of cut is 2¼" — for steel gears as coarse as 30 pitch or brass up to 20 pitch.

PIC pursues accuracy in every corner of production

As you examine the results being achieved with the No. 2½-4 by PIC Design Corporation, you will see that in their pursuit of predictability and precision, no stone is left unturned.

Bores of Precision Class 2 and 3 gear blanks are machined to +.0002", -.0000" for size and roundness. Before turning, blanks are mounted on arbors the same size as the bores, with a .0002" taper. They are inspected for face wobble and must run true within .0002" per inch of diameter before the OD's are turned to a concentricity tolerance of .0001". This operation is checked at two points, 180 deg. apart.



In hobbing, the arbors are held in a floating adapter which permits fine adjustment to desired concentricity. PIC uses only Barber-Colman Class A or AA hobs, trued on the machine to less than .0001" runout.

Evaluate your gear processing and costs

If you have the problem of producing precision fine-pitch gears at a profit or want to improve your product by increasing gear accuracy, a Barber-Colman process analyst will help you evaluate methods, tooling, and cost improvements. Phone your B-C representative or the factory — WO 8-6833.

Barber-Colman Company

BARBER COLMAN ®

81 Loomis Street, Rockford, Illinois

JONES & LAMSON "AUTOMATION"

the man who needs a new machine tool is already paying for it

This Tape Controlled Setup Punches 1483 holes – of 11 different sizes – in just 85 minutes

How's this for small lot automation? The problem is to produce 50 parts, each having 1483 holes of 11 different sizes. Hole location must be ±.002". Delivery — 2 weeks.

J & L's numerical control positioning table, applied to a standard punch press, does the job with minimum lead time, production time, and cost. Here's how:

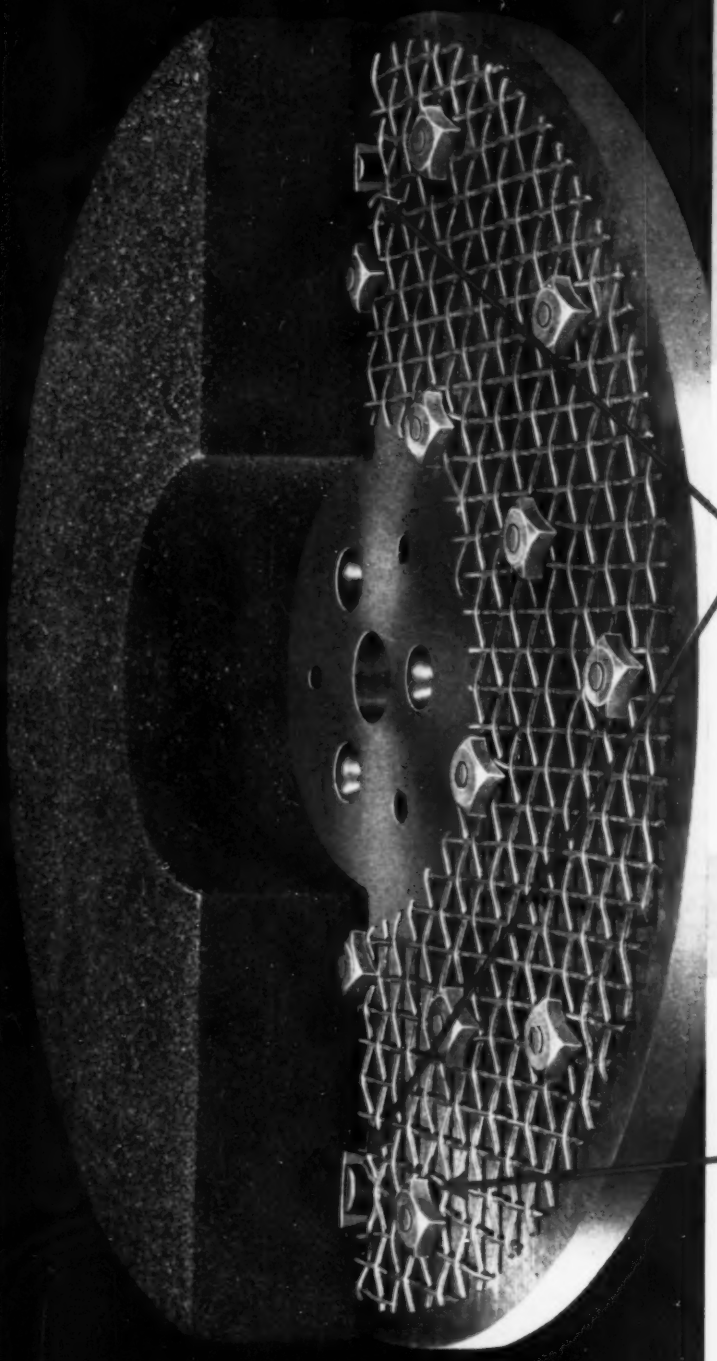
The entire tape programming for this complicated part takes only 15 hrs. There are no fixtures, templates, or dogs to be made and set. No gang tooling to prepare. No appreciable setup time.

The operator simply inserts the prepared tape, locates the work piece and pushes a button. The positioning table is then automatically controlled in any pre-arranged, random pattern. Therefore there are only 11 tool changes for the 11 sizes of holes. And — this unit tells the operator when and what tool to change.

A completed part comes off the machine every 85 minutes. Changeover for other jobs is just a matter of changing tapes and tools.

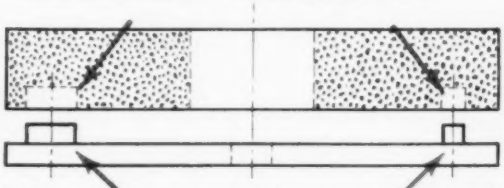
Investigate how tape control can help increase the efficiency of *your* operation. Write to Jones & Lamson Machine Company, 502 Clinton Street, Springfield, Vermont.

Turret Lathes • Automatic Lathes • Tape Controlled Machines • Thread & Form Grinders • Optical Comparators • Thread Tools



Gardner disc features add safety... improve accuracy

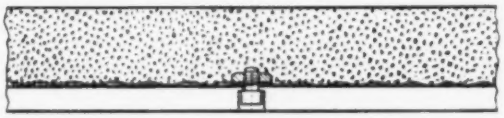
Gardner TRU-LOK® disc mounting
truer running—closer precision



Proper centering of disc on steel wheel assured by Tru-Lok.

Greater accuracy—Tru-Lok eliminates run-out and vibration caused by off center mounting.

Gardner WIRE-LOKT® construction
maximum safety—maximum economy



Full value—the entire rated thickness of the abrasive is usable.

Safety—heavy, imbedded steel mesh assures maximum safety.

Call the man who can give you the *most* in practical cost saving help with your flat surface grinding . . . your Gardner Abrasives Specialist.

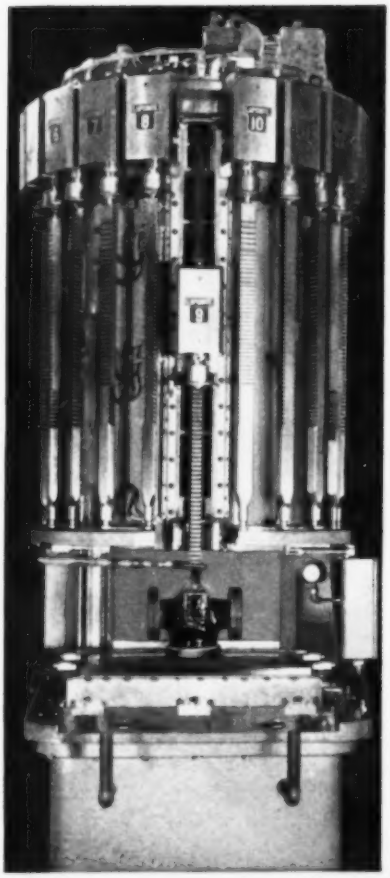
GARDNER

abrasive discs

BELOIT, WISCONSIN

production was increased 38

on this GIANT SIZE, new type LAPOINTE BROACHING MACHINE with features never before available!



Never before . . . a turret-type vertical broaching machine of this size, with in-line dead-center pull on the broach. This eliminates all stresses and strains encountered when pulling a large broach off-center. Result: remarkably smooth pulling power, exceptionally fine finish on work.

And it's not a single purpose broaching machine, but can be adapted to *any job requiring multiple internal broaching.*

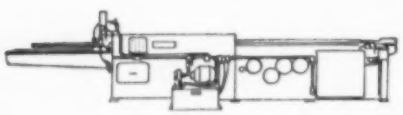
It will pay you to come to Lapointe for advice on metal-removing problems. You may find that you, too, can *convert to Lapointe-Broaching* and increase your production while at the same time you are improving your quality. A letter or phone call will bring a qualified Lapointe Field Engineer . . . *fast.*

THE LAPOINTE MACHINE TOOL COMPANY

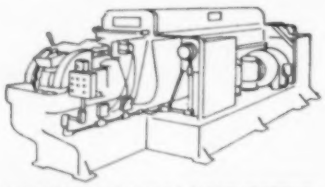
HUDSON, MASSACHUSETTS • U.S.A. *In England: Watford, Hertfordshire*

THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHING MACHINES AND BROACHES

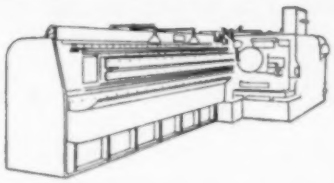
Lapointe-built Broaching Machines are available in hydraulic and electro-mechanical drives.



60" STROKE HORIZONTAL, ELECTRIC

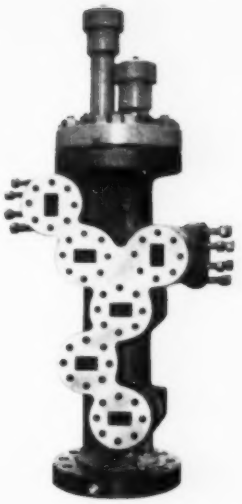


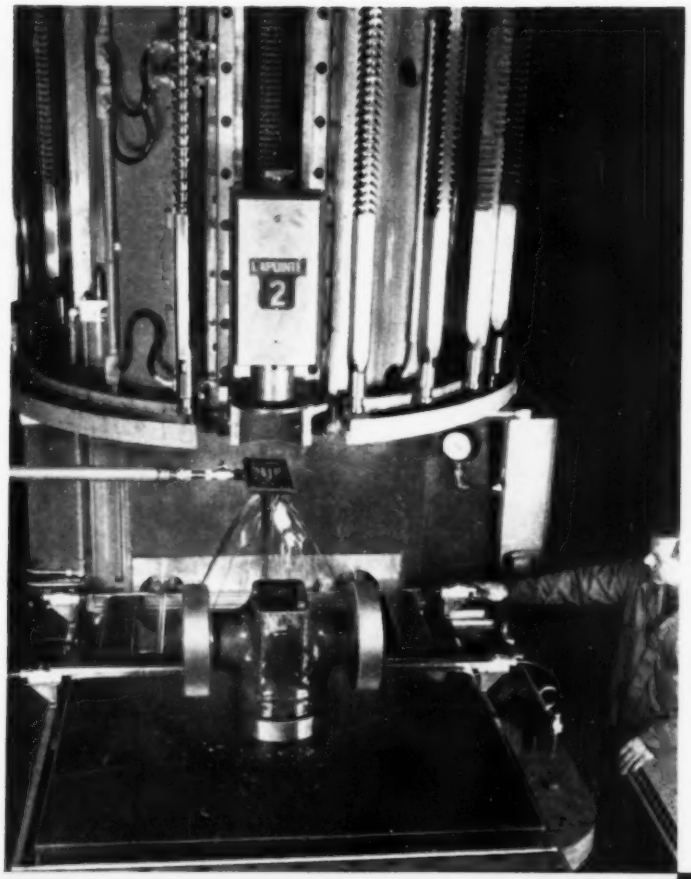
CH CONTINUOUS BROACHING, ELECTRIC



SRH SINGLE RAM HORIZONTAL, ELECTRIC

00%

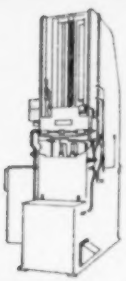




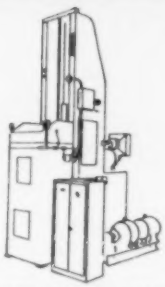
6-way oil field gate valve has six holes, 10" long, broached at rate of one hole every 15 minutes. Previously, slotting time was 13 hours per hole! Note that two holes are vertical, four are horizontal. Broaches are automatically rotated 90° into correct cutting position by the Broach Position Selector Switch. Holes are broached up to 12 1/4" long . . . with finish as fine as 20 to 25 micro-inch.

The LAPOINTE Large Pull-Down Broaching Machine is hydraulic type, 60-ton, 78-inch stroke. Overall height 36 feet, with considerable portion pitted below floor level. Automatic chip conveyor system. Maximum ease of operation, through built-in programming and complete push-button controls. Variable broaching speed, to maximum of 25-feet-per-minute.

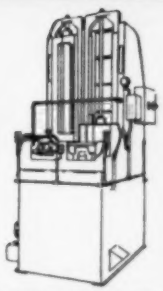
Turret, 6 feet in diameter, has 21 stations for storing the 80-inch long broaches. Designed with variable speed hydraulic motor drive, turret is pre-set by the operator. No manual handling of the broaches is required, once they are positioned in the turret.



VUE-7 VERTICAL PULL-UP ELECTRIC



SRVE SINGLE RAM VERTICAL, ELECTRIC



DRVE DOUBLE RAM VERTICAL, ELECTRIC

LAPOINTE

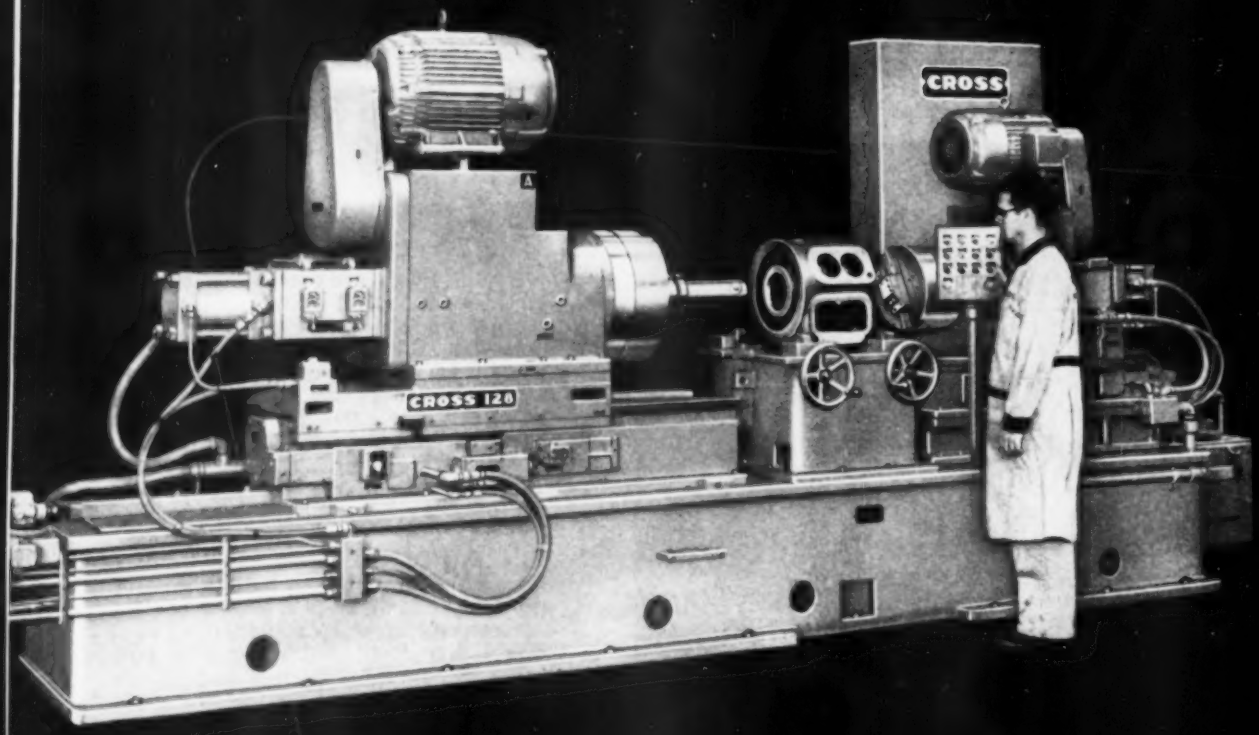
known to be the best in

BROACHING

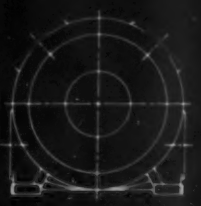
CIRCLE 176 READER SERVICE CARD

CIRCLE 177 READER SERVICE CARD ►

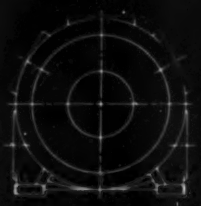
Automation for Short Run, Low Volume Production



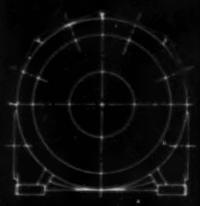
PRODUCT MIX



Two-bank compressor for several 4 cylinder models.

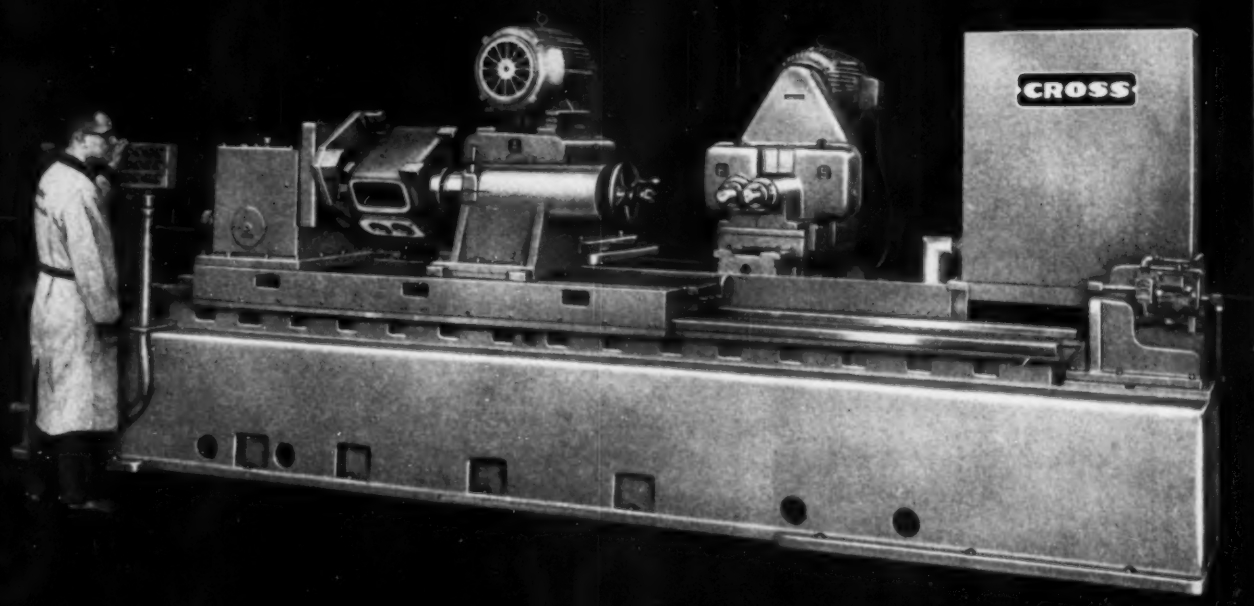


Three-bank compressor for several 6 cylinder models.



Four-bank compressor for 8 and 12 cylinder models.

More Specials by Cross



Featuring a high degree of precision, processing versatility and machine flexibility, these two new Cross machines process a complete product mix of 4, 6, 8 and 12-cylinder hermetic compressor housings in lots of 50 each. The two-way boring and facing machine rough and precision finishes crankshaft bores, thrust faces and the motor mounting face. The two-station shuttle-type machine rough and finishes all bank faces and cylinder bores.

Both machines provide completely automatic operations including part indexing and shuttle; incorporate automatic lubrication including new methods of lubricating cross facing heads automatically; and both provide optimum flexibility for handling future part design changes including major dimensional variations in the number, diameter and location of cylinder bores.

Both the two-way and shuttle machine combine rugged dependability for heavy stock removal in roughing with a high degree of accuracy for precision finishing. Critical tolerances are held closely; bank and thrust faces relative to cylinder bores are held square within .001"; main bore and cylinder bore diameters concentric within .001"; motor mounting face and crank bore thrust faces held parallel within .001".

The two-way and shuttle machines are smaller and far less costly than a group of standard machines that would be required to perform identical operations without automated features and advantages.

Both machines incorporate standard Cross "Building Blocks" including wing bases and feed units. All standard and special parts are completely interchangeable for easy servicing.

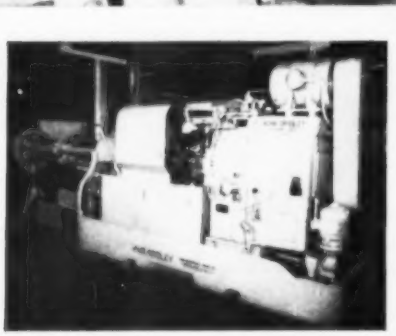
For details on these—and other automated Cross machines for profitable, low volume production, write, wire or phone:

Established 1898

THE CROSS CO

First in Automation

PARK GROVE STATION • DETROIT 5, MICHIGAN



1⅛"-RB6 Acme-Gridley producing 266 thermometer sockets per hour at Manning, Maxwell & Moore, Inc., Stratford, Connecticut, manufacturers of industrial thermometers and gauges.

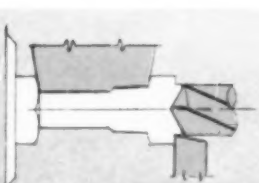
Close-up of tooling zone showing 4th and 5th position operations.

Spindle-for-Spindle

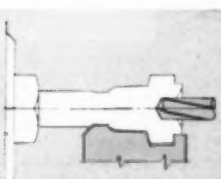
PRODUCTION INCREASED OVER 200%

for Manning, Maxwell & Moore, Inc.

12 Operations in 22 Seconds



6. **Rough Form Rear Diameters —Spot Drill—Turn Front Diameter**



1. **Finish Form Thread and Front Diameter—Drill ⅜" Diameter**

NATIONAL ACME'S "ZONE OF RESPONSIBILITY"
INCLUDES ALL PHASES OF COST REDUCTION

Check YOURS . . . Then Check National Acme

Direct Costs: these include direct dollar savings as realized by Manning, Maxwell & Moore, Inc. . . . an "every day" job for Acme-Gridleys.

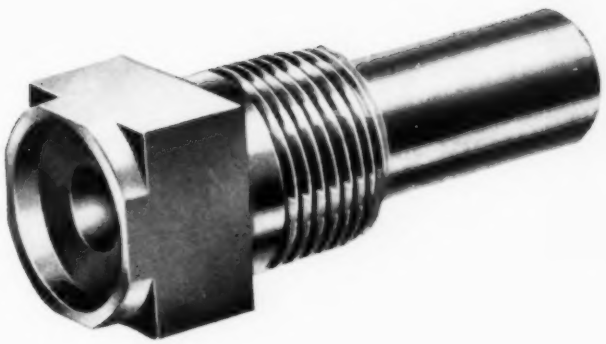
Indirect Costs: effecting important savings in maintenance, downtime, scrap reduction, tool costs, etc.

Product Redesign: teaming with your design group to take full advantage of Acme-Gridleys' cost reducing capabilities.

Direct Material Costs: our engineers provide important savings in this area by constantly matching machines and tools to modern metallurgical problems.

Make-or-Buy Reviews: in many cases our Contract Division can assume your production headaches and relieve you of immediate capital investment.

Spot Modernization: pioneering in modern tooling methods, and the flexibility of Acme-Gridleys can provide many "on-the-spot" savings.

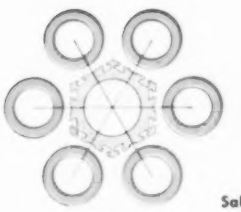


"*Cost-per-piece is substantially reduced* . . . and our increased production has enabled us to keep ahead of competition," says this manufacturer of precision industrial thermometers, gauges and valves.

"Former automatics could not keep pace with production requirements . . . many parts had to be 'farmed out', thus increasing our costs. In addition, the only downtime has been the short periods necessary for tool grinding. What's more . . . a secondary operation for deep-hole drilling was completely eliminated!"

Further benefits were realized with Acme-Gridleys' quick-change, quick-setting toolholders and wide-open tooling zones which enabled Manning, Maxwell & Moore to produce two other parts on the same machine...with only minor changes in the set-up. Add to this the extreme accuracy and flexibility of direct camming and independently operated toolslides, and you will realize why this manufacturer found his Acme-Gridleys a profitable investment.

It will pay *you* to investigate the complete story on the industry's more modern approach to cost reduction. Call, write or wire.

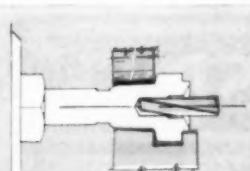


Pioneer in Circumferential Automation

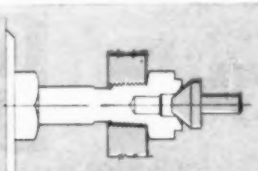
National Acme

THE NATIONAL ACME COMPANY
171 E. 131st STREET
CLEVELAND 8, OHIO

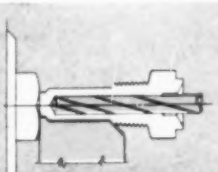
Sales Offices: Newark 2, N.J.; Chicago 6, Ill.; Detroit 27, Mich.



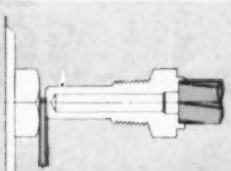
2. Shave Thread and Front Diameter—Drill 5/16" diameter partway



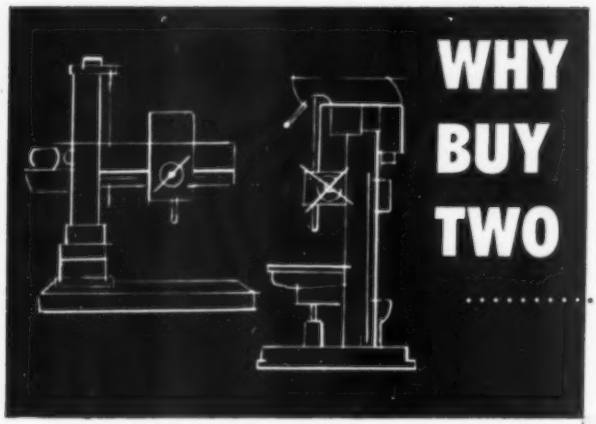
3. Roll Thread—Support



4. Finish Form Rear and Breakdown for Cutoff—Drill 5/16" diameter remainder



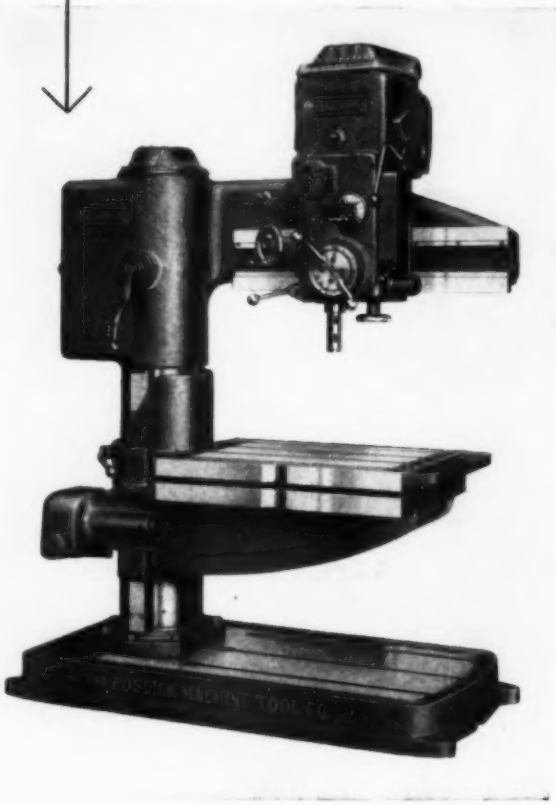
5. Counterbore Large Diameter—Cutoff



WHY BUY TWO ..... WHEN one WILL DO?

Fosdick's Sensitive Radial combines Upright and Sensitive features—rigidity, compactness and convenient table height—with the capacity and flexibility of a Radial. Fosdick has made the table unusually adjustable, leaving the arm at a fixed height. The unique, one-piece column construction makes possible unusual rigidity. Arm clamping is simplified. You get *all* the advantages of *both* the old reliable drills, at roughly the cost of one!

Workpiece sizes accommodated by the Sensitive Radial include the ranges of both Uprights and Radials; setting up on either the adjustable table or the base of the machine. Controls remain clustered at a constant, convenient operator's height.



YOUR TOOL DOLLAR buys more capacity in less shop space when you put Fosdick's compact versatility to work on your drilling problems. Only Fosdick builds the Sensitive Radial. Call your distributor or write for Bulletin SRA.

THE FOSDICK MACHINE TOOL CO., CINCINNATI 23, OHIO

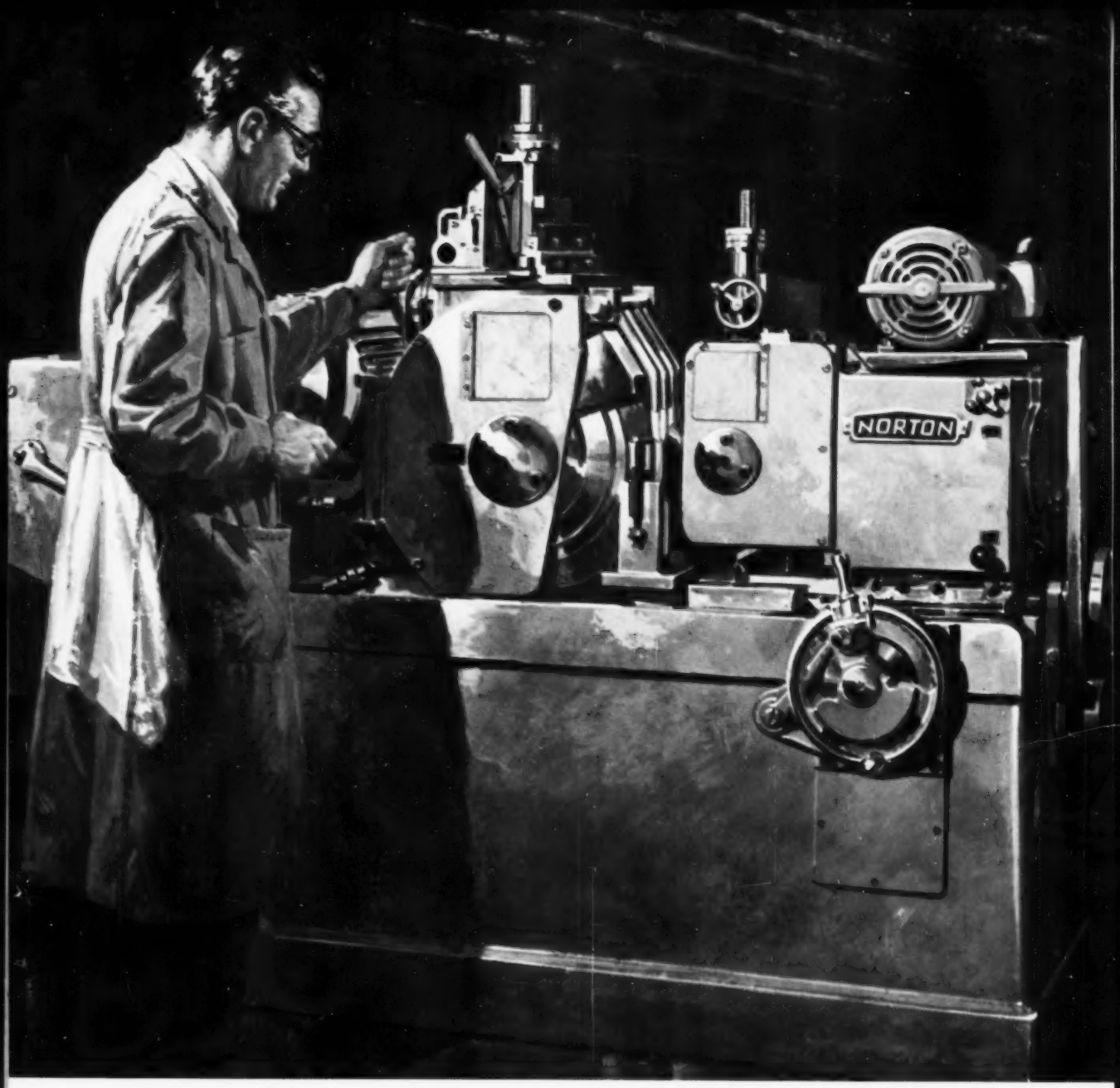
RADIAL DRILLS
SENSITIVE AND UPRIGHT DRILLS
JIG BORERS & GRINDERS
NUMERICAL CONTROLLED PRECISION BORING MACHINES
SENSITIVE RADIAL DRILLS

FOSDICK

◄ CIRCLE 180 READER SERVICE CARD

CIRCLE 181 READER SERVICE CARD

CIRCLE 182 READER SERVICE CARD ►



Now you can add the "Touch of Gold" . . . with the new Norton centerless grinder

The ability to produce better products at lower cost is an *extra* built into every Norton grinding machine.

Now, for the first time, this "Touch of Gold" performance is available in a centerless grinder. The new Norton No. 2 Centerless Grinder, the latest addition to the world's largest line of grinders and lappers, is ready for immediate delivery.

How this sensational new grinder can help you get a new start against competition is worth knowing. Get the whole story from your Norton Man, soon. NORTON COMPANY, Machine Division, Worcester 6, Mass.

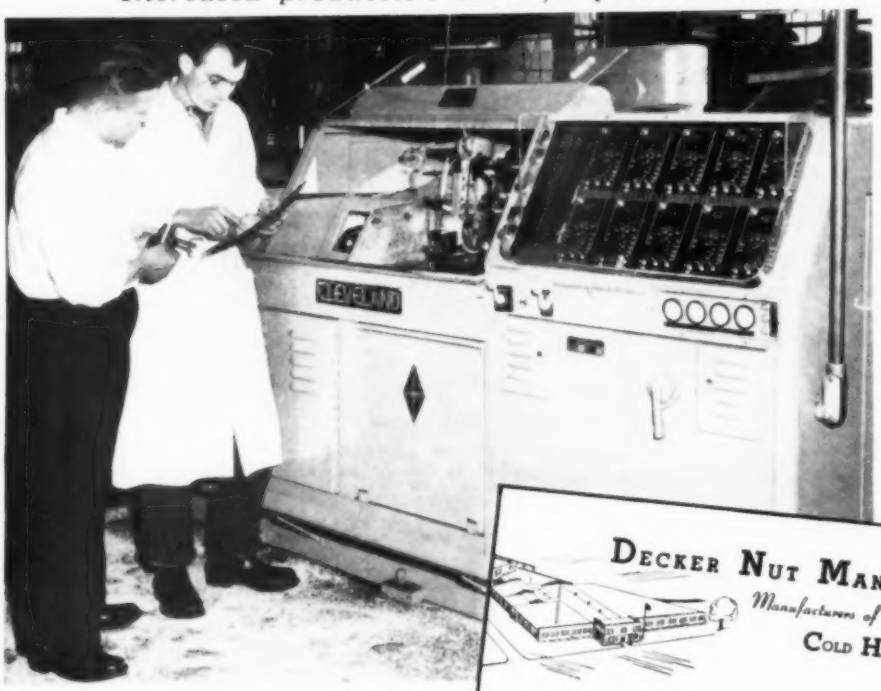
NORTON
GRINDERS and LAPPERS

Making better products . . . to make your products better

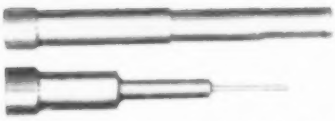
NORTON PRODUCTS: Abrasives • Grinding Wheels • Grinding Machines • Refractories • Electrochemicals — **BEHR-MANNING DIVISION:** Coated Abrasives • Sharpening Stones • Pressure Sensitive Tapes

CLEVELAND 1⅝" DIALMATIC

"Increased production 500%", reports Decker Nut Mfg. Corp.



With *dial control* of infinitely variable spindle speeds and turret tool feeds, this 1⅝" Model AB Cleveland Single Spindle Automatic has increased production 500% on close tolerance machining of cold heading tools for Decker Nut Mfg. Corp. Typical tools are shown below. Shown at the machine are R. R. Hunt, foreman, and B. L. Konkle, operator and set-up man.



TOP—Long pierce punch (H. S. Steel) machined in 5 operations. Cleveland time: 20/hr. gross. Lathe time: 7/hr. gross.

BOTTOM — Short pierce punch (H. S. Steel) machined in 6 operations. Cleveland time: 17/hr. gross. Lathe time: 7/hr. gross.

Square die (High C-High Cr Die Steel) machined in 7 operations. Cleveland time: 10/hr. gross. Lathe time: 22 min. each.

Nose die (Cr-W Tool Steel) machined in 7 operations. Cleveland time: 9/hr. gross. Lathe time: 25 min. each.

DECKER NUT MANUFACTURING CORP.
Manufacturers of
COLD HEADED INDUSTRIAL FASTENERS
Albion, Michigan

Cleveland Automatic Machine Company
Cincinnati, 12, Ohio

Gentlemen:- Attention: Mr. Pronaska

The 1-5/8 Dialmatic which we purchased recently has resulted in substantial savings in our toolroom cost. These savings were realized immediately. Where we had been using lathes to make tools for our cold-heading equipment we now use the Dialmatic completely.

The use of this machine has increased production of tools at least 500%. Coupled with the savings in time and labor we have reduced the possibility of human errors to practically nothing. This machine runs exclusively on tool steels at very close tolerances.

Our satisfaction with your equipment would not be complete without mentioning the fine cooperation that we receive from your sales and service people.

Should it be necessary to increase our facilities along this line, your equipment will most certainly be our choice.

Yours very truly,

DECKER NUT MANUFACTURING CORP.,

Edwin W. Konkle

Edwin W. Konkle
Pres. & Gen. Mgr.

EWK/CT

Let a Cleveland field engineer show *you* how *Clevelands Cut Costs!* For machine specifications write for General Bulletin.

THE CLEVELAND AUTOMATIC MACHINE COMPANY

4928 Beech Street
Cincinnati 12, Ohio

SALES OFFICES: CHICAGO
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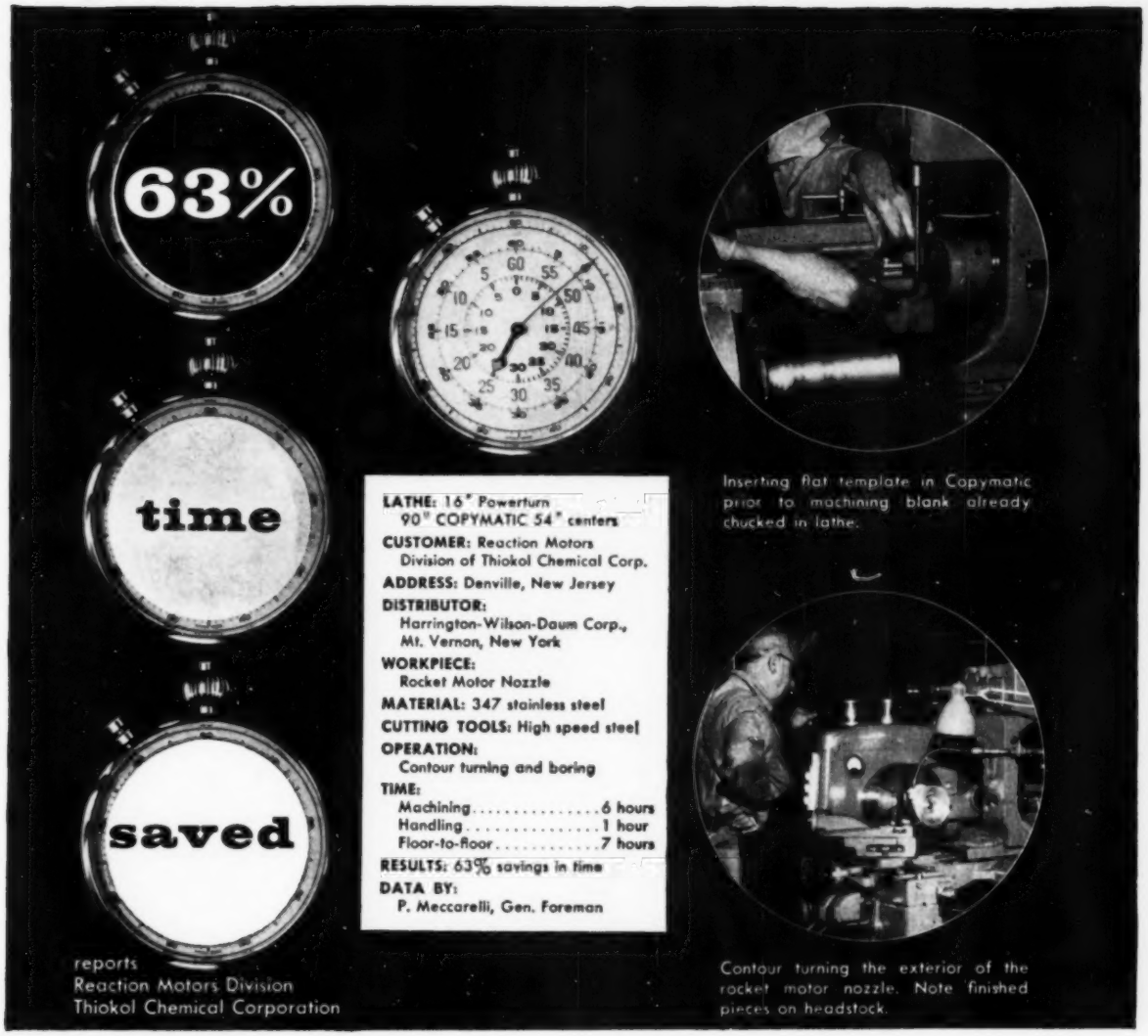
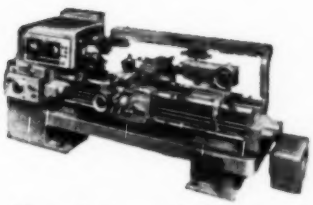
HARTFORD • S. ORANGE

Manufacturers of a Complete Line of Single Spindle Automatic Screw Machines and High Pressure Hydraulic Die Casting Machines



by this Lodge & Shipley Powerturn Copymatic Lathe



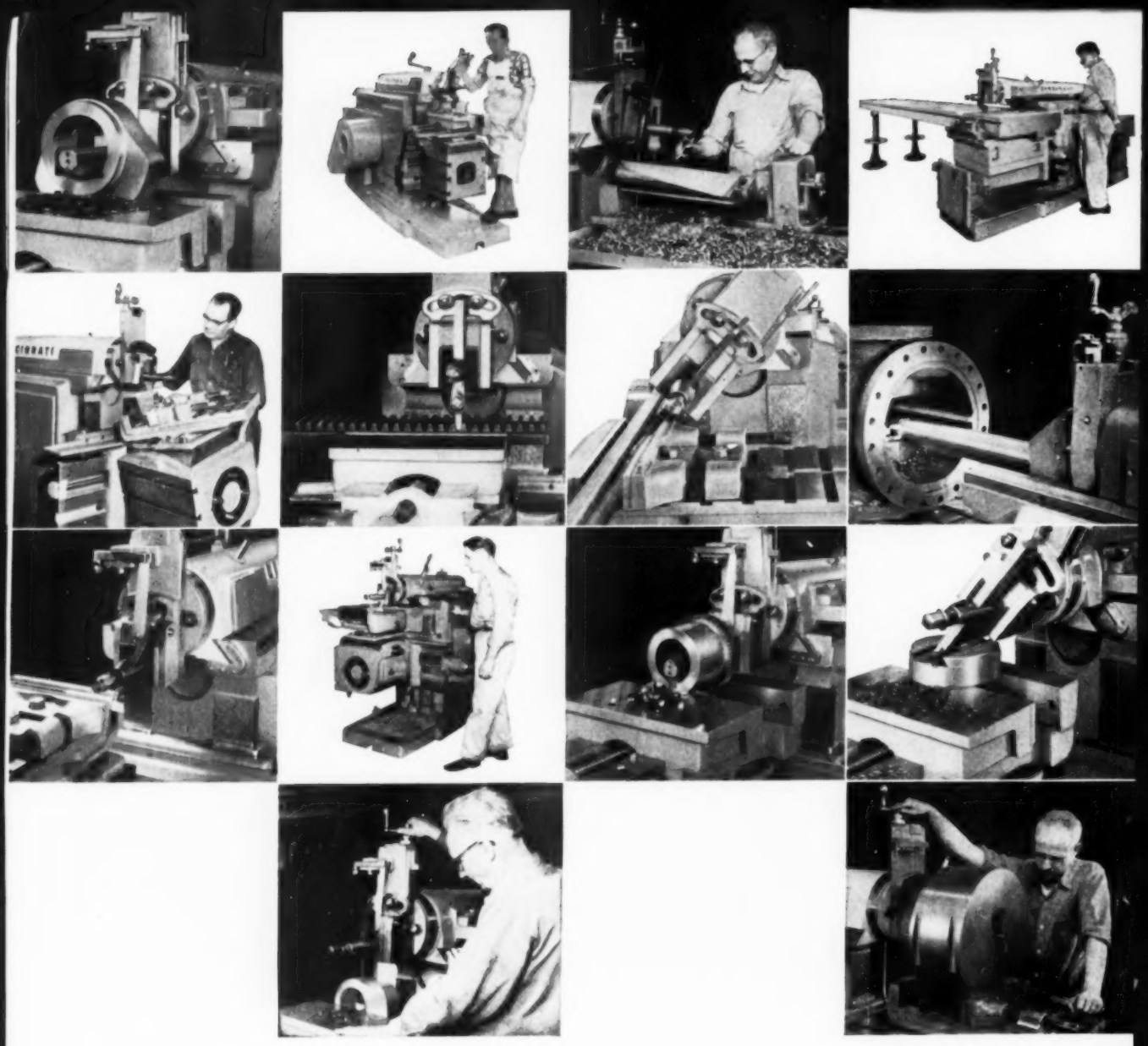
A pioneer in jet propulsion, Reaction Motors Division of Thiokol Chemical Corp., Denville, N. J., plays an important part in America's rocket defense and space exploration programs. In turn, and in turning, a Lodge & Shipley POWERTURN COPYMATIC plays an important part in rocket motor production.

In contour turning and boring a typical reaction motor nozzle, the COPYMATIC cuts 12 hours from the previous time, completing the job in 6 hours machine time and one hour handling time.

Whether you're machining the new and tougher alloys or the old stand-by metals, you'll appreciate the strength, rigidity and extra power available in Lodge & Shipley Lathes. For special jobs or routine operations, the speed and accuracy of these world famous lathes offers much to virtually any lathe user.

Investigate the time and money-saving possibilities of Lodge & Shipley COPYMATIC Lathes with 45° or 90° tracer slides. Contact your Lodge & Shipley representative or write for literature:
The Lodge & Shipley Company, 3056 Colerain Ave., Cincinnati 25, Ohio

More than ever before, your LODGE-ical choice . . . **Lodge & Shipley**



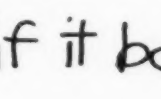
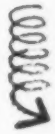
PAYOFF: VERSATILITY

In the tool shop or in your high production bay, the wide-ranging versatility of a Cincinnati® Rigid Shaper gives you maximum productivity for your invested dollar. And for each of the many jobs you can do on it, a Cincinnati Rigid Shaper produces something extra – in metal cut per hour, in accuracy, in ease of operation. See for yourself why a new Cincinnati® Shaper would pay off for you: write Dept. A for Catalog N-7.

Shapers / Shears / Press Brakes

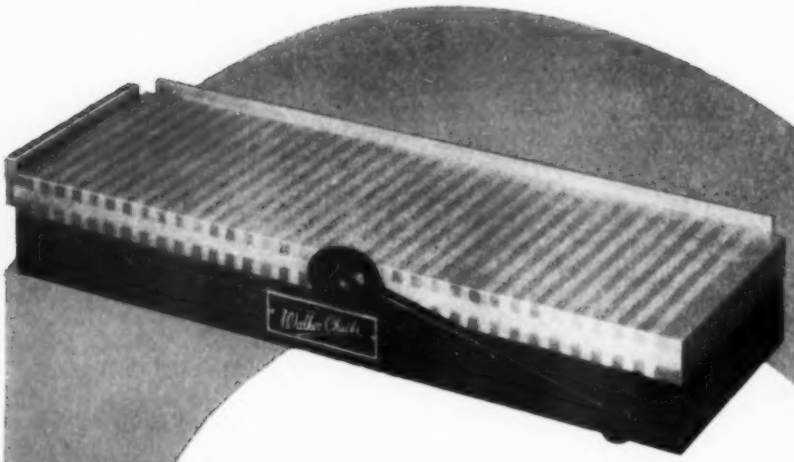
THE CINCINNATI SHAPER CO. Cincinnati 11, Ohio, U.S.A.

CIRCLE 186 READER SERVICE CARD

If it rolls on an axle or turns in a bearing or rides on a shaft if it slides in a groove or moves on a pivot  if it bores  or cuts or transmits pressure one of Sinclair's 500 specialized lubricants is designed to make it work better. For answers to your lubrication problems, write today to

SINCLAIR REFINING COMPANY

Technical Service Division
600 Fifth Ave, N.Y. 20 N.Y.



Finest, **Most Complete Line of Permanent Magnetic Chucks***

O. S. Walker offers the world's finest chucks – both rectangular and rotary – in a full range of sizes. Their magnets are the most permanent magnets ever produced! They're ceramic, with many times the coercive force of alloy magnets. The face of every chuck is *all steel* (no soft insulating material). Other important features: 50% less weight; low, low height; fine pole divisions for maximum holding power; easy "on-off" lever, with complete demagnetization in "off" position. Write for catalog.

*Patents Pending

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O.S. WALKER COMPANY, INC.
WORCESTER 6, MASS.

O. S. Walker – The Original Designers and Builders of Magnetic Chucks!

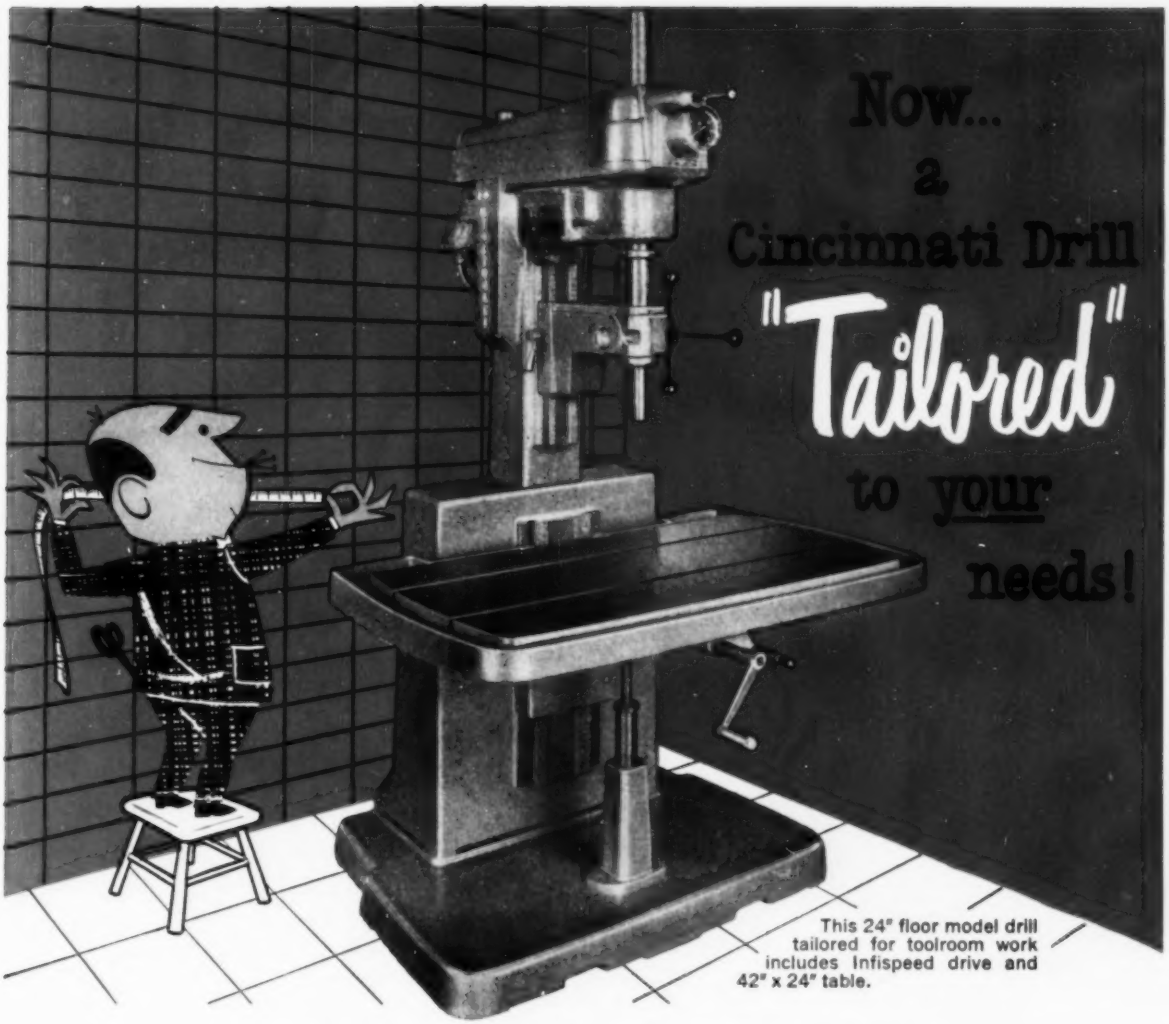
Special vacuum chucks for holding non-ferrous parts

Bar pole electro-magnetic chucks in 81 sizes

Electro-magnetic chucks in 172 sizes

Special electro and magnetic chucks and magnetic holding fixtures

Standard and special demagnetizers



This 24" floor model drill tailored for toolroom work includes Infispeed drive and 42" x 24" table.

Buy your new medium duty 16" or 24" CINCINNATI Sliding Head Drill just as you want it—with selected specialized equipment factory-installed and tested! Buy only the cost-saving combination you need to suit your toolroom, production or job shop requirements EXACTLY!

NEW BACK-GEAR SPINDLE DRIVE

7½ to 1 ratio Back-Gear—12 spindle speeds with Standard drive, infinite selection with Infispeed. Full torque over entire 60—3000 RPM range. Controls at front of machine.

INFISPEED VARIABLE SPEED DRIVE

Provides exact spindle speed for each job. Indispensable for operations requiring frequent spindle speed changes.

NEW BUILT-IN ELECTRICAL TAPPING ATTACHMENT

Manual tap reversal by hand feed lever; automatic reversal by depth stop.

NEW PRECISION DEPTH STOP

Direct-reading dial permits quick settings to .005". Positive stop for sensitive hand feed; automatic disengagement when used with new "torque-load" power feed precision controlled to .005".

OTHER COMBINATIONS include Geared and Air Power Feeds, Manual and Automatic Work Holding Fixtures, Wide Selection of Plain or T-Slotted Work Tables, Variety of Spindle Types and Sizes, Motor Driven Coolant Pump, and other Cost-Reducing Attachments.

See your CL&T Dealer, or write us direct.

Improved Machining Through Research

CINCINNATI LATHE AND TOOL CO.

3207 Disney Street • Cincinnati 9, Ohio

"TRAY-TOP" Lathes / "CINCINNATI" Drilling Machines / "SPIROPOINT" Drill Sharpeners

ARMSTRONG
TOOL HOLDERS
A Correct Tool for Every Lathe Operation

You can save time (and money) by ensuring that your machine tools are equipped with *adequate numbers* of the correct ARMSTRONG Tool Holders. The ARMSTRONG System of Tool Holders includes correctly designed tools for *every* standard operation on lathes, shapers, and planers, and for many operations on turret lathes and screw machines. By utilizing the ARMSTRONG System of Tool Holders, you can reduce tooling costs, eliminate down time in tooling up, operate your machine tools at maximum feeds and speeds.

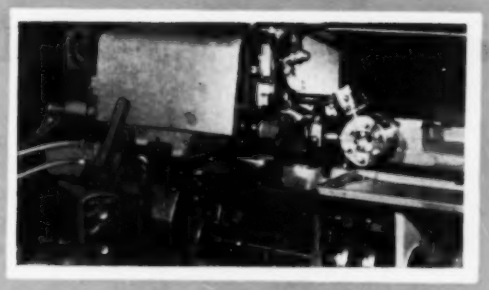
ARMSTRONG Tool Holders are long-lasting tools. They are strong beyond need, handy and efficient, profitable to use, and are readily available from your local ARMSTRONG Distributor.

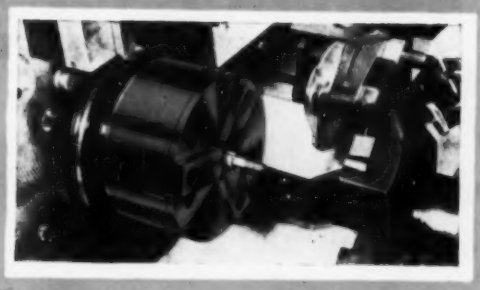
Check over your ARMSTRONG Tool Holder needs.
Write for literature.

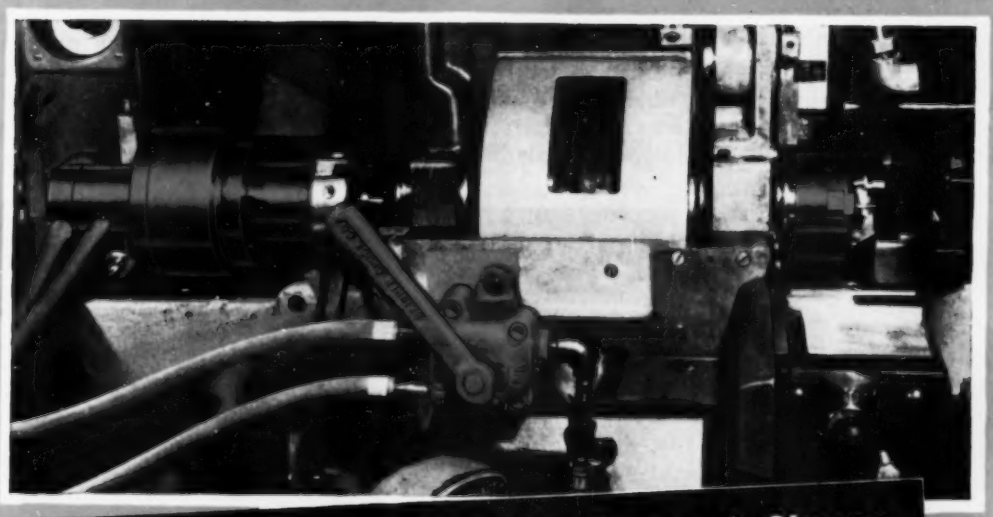
INDUSTRIAL DISTRIBUTORS · THE RIGHT HAND OF PRODUCTION ·

If you do not know the name of your local ARMSTRONG Distributor, inquire when asking for literature.

ARMSTRONG BROS. TOOL CO. 5215 W. ARMSTRONG AVE. CHICAGO 46, ILL.







Now You Can Convert Your Brown & Sharpe Automatic Screw Machine to Air Chucking

It is now possible to convert the Brown & Sharpe Automatic Screw Machine to power chucking by means of a Skinner power chucking unit designed for the Models 2 and 2G.

The Skinner power chucking unit consists of a 4-inch air chuck with two or three jaws, soft blank work-holding top jaws, a threaded draw bar, a rotating air cylinder, a cylinder adapter and a control valve. This unit can be installed easily in ninety minutes by any set-up man.

With the addition of this Skinner power chucking unit, your Brown & Sharpe Automatic Screw Machine can chuck cold drawn and odd shaped parts at higher speeds and at less cost.

For greater production, automatic feed hoppers, work ejectors and automatic cam controls can be added to provide automatic chucking that will permit an operator to tend more than one machine.

If you plan to purchase a Brown & Sharpe Automatic Screw Machine ask to have the Skinner power chucking unit included. To convert your present Model 2 or 2G, contact a Skinner Representative or write us at Dept. 108.

SKINNER CHUCKS

THE CREST OF QUALITY

THE SKINNER CHUCK COMPANY • NEW BRITAIN, CONNECTICUT

Allen Hughes

cut abrasive costs 18 to 1 at

Grinding the gripper-die marks off a jet turbine blade can be an expensive business. At the Harrisburg Works of Thompson Ramo Wooldridge, these super-alloy steel blades used to be semi-finished with coated abrasive belts until Industrial and Abrasive Control Engineer Paul Mazich started checking up on costs.

Mazich called in Bay State Abrasive Engineer Allen B. Hughes and he dug into the problem. Working with Bay State distributor General Machinery & Equipment Company, Hughes made a series of careful tests. The result was a grinding wheel that cut the annual cost of abrasive materials alone from $18,000 to $1,000. Its unique combination of special bond and abrasive grit increased cutting speed, prevented loading and eliminated the need for dressing so successfully that productivity rose, labor costs dropped and there were additional savings of around $5,000.

Like Allen Hughes, the Bay State Abrasive Engineer in your area is a trained expert. He backs up the work of the experienced men who represent Bay State's topflight distributors and Bay State's research labs back them both with new ideas, techniques and materials. *Better grinding at lower cost . . . that is our business.*

Industrial Engineer Paul Mazich examines finish on jet engine blade forging after off-hand grinding operation illustrated at right.

Operator E. S. Jones semi-finishes jet turbine blade in off-hand grinding operation with cool-cutting, self-dressing Bay State grinding wheel.

Thompson Ramo Wooldridge

Allen B. Hughes worked up through Bay State's Westboro plant and then added extensive field experience so that his knowledge of abrasive problems and practical solutions for them covers every phase of abrasive engineering.

BAY STATE ABRASIVES

BAY STATE WHEELS of PROGRESS

Bay State Abrasive Products Co., Westboro, Massachusetts.
In Canada: Bay State Abrasive Products Co., (Canada) Ltd., Brantford, Ontario.
Branch Offices: Bristol, Conn., Chicago, Cleveland, Detroit, Pittsburgh, Los Angeles. *Distributors:* All principal cities.

When you see uniformity, remember...

With Card gages you get uniformity

Your production's consistent ...because Card gages are uniform

. . . And they incorporate the finest quality materials and craftsmanship. These gages are produced from top quality steels by today's most advanced manufacturing methods. At every stage of production they're under the watchful eyes of men with years of metalworking experience. The result of this quality control is unvarying precision in every gage produced. Let a Card technical man show you exactly how this uniform high precision will pay off in your plant.

S. W. CARD DIVISION, Mansfield, Mass. Card Warehouses: Atlanta, Chicago, Detroit, Fort Worth, Los Angeles, New York, San Francisco.

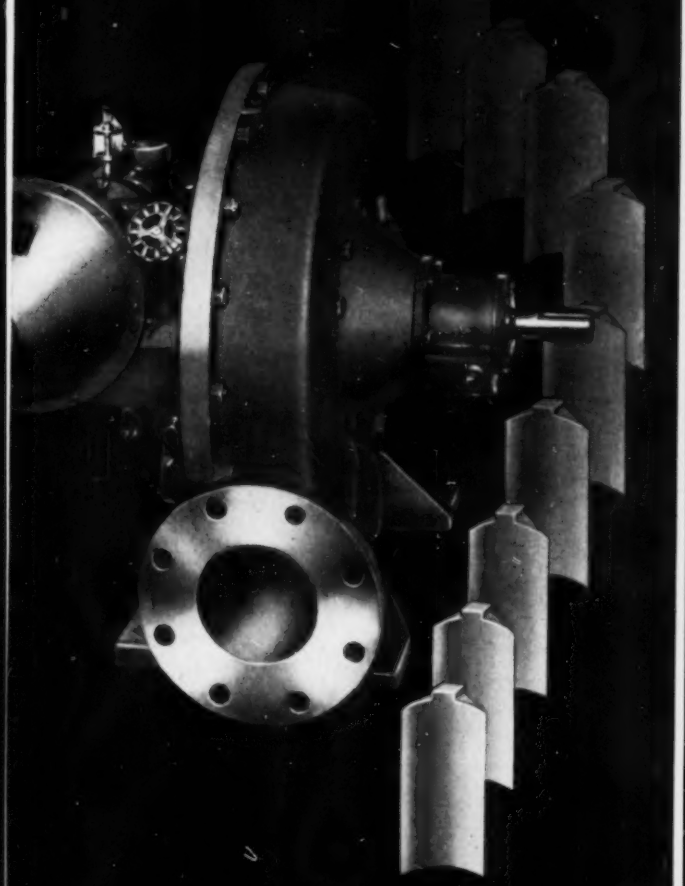
CARD

DIVISION OF UNION TWIST DRILL COMPANY

— Serving you through the best distributors from Coast to Coast

CIRCLE 193 READER SERVICE CARD

If you use end mills the way turbines use blades . . .



Ordering Union end mills will cut your production time and costs

The more you use end mills the more you need Union

Choosing from the broad variety of Union end mills, you'll find the new center cutting types ideal for plunge cutting and pocketing cuts. Made with 4 flutes, they mill in any direction with speed and economy, and provide extra fine finishing. In plants throughout the country Union technical men have proved that the time and costs of many production operations can be reduced with Union end mills, drills, milling cutters, gear cutters, reamers, hobs, carbide tools and inserted blade cutters. **Available nationally through Union Distributors** and stocked in Union warehouses in Atlanta, Chicago, Detroit, Fort Worth, Los Angeles, New York City and San Francisco.

UTD

UNION

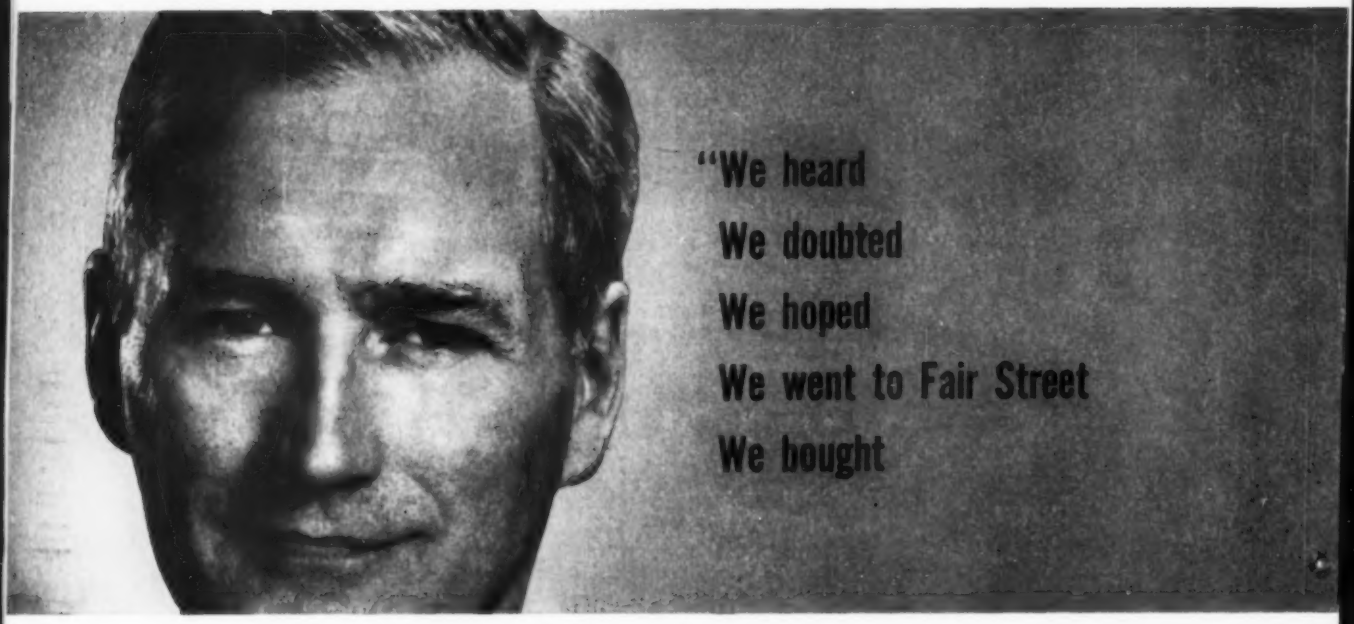
TWIST DRILL COMPANY, Athol, Massachusetts

S. W. CARD DIVISION, Mansfield, Mass.; BUTTERFIELD DIVISION, Derby Line, Vt.

CIRCLE 194 READER SERVICE CARD

C. J. GANO, Vice-President & Plant Manager,
Speco Division, Kelsey-Hayes Co.

a man who came to Fair Street



"Two more DeVlieg JIGMILS rapidly followed the first. Continued proof of precision, speed and versatility caused us to buy an additional two machines.

With our JIGMILS we no longer use an expensive machine as a planning desk. We no longer build expensive boring fixtures. The JIGMIL Technique solves these problems and saves both time and scrap.

Our DeVlieg JIGMILS give us the versatility needed in our 'Overgrown Job Shop.' We can make prototypes with the same accuracy as tooled jobs and continue our production without expensive retooling and loss of time."

C. J. GANO

DE VLIEG MACHINE COMPANY, FAIR STREET • **ROYAL OAK, MICHIGAN**

CIRCLE 195 READER SERVICE CARD

SOME OF OUR JIGMIL USERS

Adams Div., LeTourneau-Westinghouse Co.
Akron Standard Mold Co.
Allen Tool Corp.
American Machine & Foundry Co.
Andale Company
Baker-Perkins, Inc.
Bell Aircraft Corp.
Bendix Products Div. of Bendix Aviation Corp.
Bryant Chucking Grinder Co.
Buick Motor Div., General Motors Corp.
J. I. Case Co.
Cleveland Trencher Co.
Danroy Boring Co.
Daystrom Inc.
Denison Engineering Div. American Brake Shoe Co.
Eclipse-Pioneer Div., Bendix Aviation Corp.
Emsco Manufacturing Co.
Evans Reamer & Machine Co.
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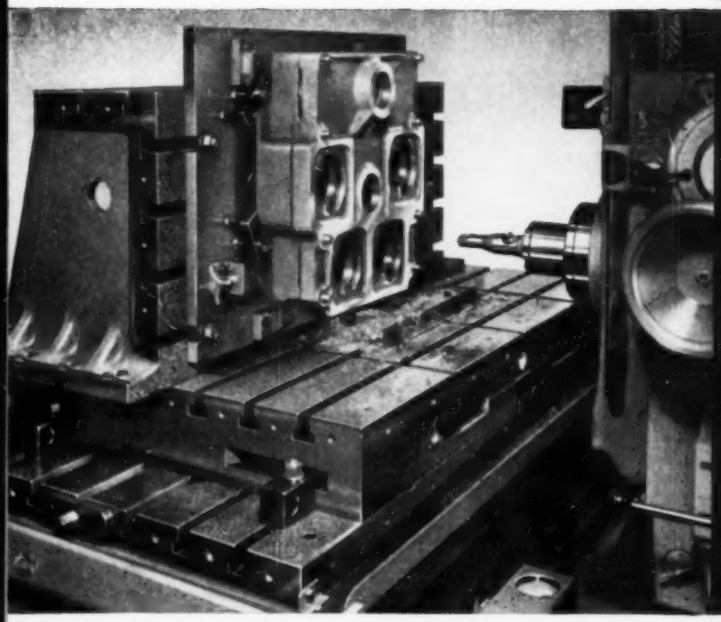
R. H. Freitag Mfg. Co.
Goodyear Tire & Rubber Co., Inc.
Halliburton Oil Well Cementing Co.
Heintz Div. Kelsey-Hayes Co.
Hughes Tool Co.



A FEW PROVEN ADVANTAGES OF THE JIGMIL TECHNIQUE

- Eliminates cost of expensive jigs and production delays resulting from their manufacture.
- Simplifies tooling.
- Employs automatic functions to reduce factors of human error even in close tolerance work.
- Makes possible greater flexibility of product design.
- Improves end product by permitting interchangeable assembly of parts without hand fitting.
- Increases production and product accuracy.

ACCURACY IS AN ECONOMY!

ANOTHER EXAMPLE OF JIGMIL PRECISION
applied to guided missile production

Speco Division, Kelsey-Hayes Co., uses the JIGMIL Technique to bore and mill to precise limits of accuracy a wide range of guided missile components such as the one above. Because of their speed, accuracy and versatility, Speco also uses its 5 JIGMILS in the production of such critical items as aircraft and helicopter transmissions, hydraulic control systems, radar antennas, rocket and jet engine precision gears and assemblies.

Improved Paper Machinery Corp.
McDonnell Aircraft Corp.
Mechanical Specialties Co.
Michigan Drill Head Co.
Oil Well Supply Div. U.S. Steel Corporation
Paramount Boring & Machine Co.
Princeton University, Forrestal Research Center
Rheem Mfg. Co.
Sandia Corp., Sandia Base, U.S. Atomic Energy Comm.
Stanley Aviation Corp.
Teppert Tool & Eng., Inc.
Van Norman Machine Company
Wabash Mfg. Co., Inc.
Wiedemann Machine Co.
Worthington Corporation

WILL YOU BE THE NEXT TO VISIT FAIR STREET

Our newest catalog will help you decide. May we send it?

DeVlieg

SPIRAMATIC JIGMILS®

ACCURATE HOLES AND FLAT SURFACES IN PRECISE LOCATIONS

CIRCLE 196 READER SERVICE CARD

Bridgeport Ultra Fine Grain Brass Strip Saves Siesta-Ware $2,400 a Year

Colorful Siesta-Ware is designed to create a holiday mood ... and so are the remarkable production savings realized by Benner Glass Company!

Before Benner Glass Company, Jacksonville, Fla., made the happy discovery of Bridgeport Ultra Fine Grain Brass Strip, production of the brass banding on each attractive Siesta-Ware Party Mug, Snack Jar and Tumbler was at the rate of two coils of strip running at 35 lineal fpm through three buffing stages. Today, with Bridgeport UFG Strip, the same machine runs *at the rate of 48 fpm!*

There's a simple reason why Benner Glass now realizes 23% time savings and 8% savings on polishing materials. It is this: the infinitely superior finish of Bridgeport Ultra Fine Grain Strip requires far less buffing. Important savings in time, cutting compound and buffing naturally result. In the annual processing of Bridgeport coiled strip, Benner saves more than $2,400 ... while turning out an even better finished product!

Don't *you* overlook the sizable savings that can be yours when you switch to Bridgeport Ultra Fine Grain Brass Strip. To get the facts and figures as they apply to your products, call *your* nearby Bridgeport Sales Office ... or write direct for a copy of our Ultra Fine Grain Brass Booklet, GRAIN SIZE, THE FOURTH DIMENSION. Dept. 3009

BRIDGEPORT BRASS COMPANY

BRIDGEPORT 2, CONNECTICUT

Specialists in Metals from **A***luminum to* **Z***irconium*

Start saving money right now on threading jobs like these with...

COUPLING - STAINLESS 316
1.25 N.P.T.
THREADING TIME - 3 MIN. 24 SECS.
SINK FLANGE - STAINLESS
3.341 IN. DIA. - 10 TPI
THREADING TIME - 37 SECONDS
LIFT NUT - STEEL B-1112
1.400 IN. DIA. - 4 TPI
THREADING TIME - 30 SECONDS
BODY - STAINLESS STEEL
1.25 IN. DIA. - 24 TPI
THREADING TIME - 7 SECONDS
ADAPTOR - ZINC ALLOY
8 TPI-INT., 16 TPI-EXT. SIMULTANEOUS
THREADING TIME - 12 SECONDS
SCROLL - A.I.S.I. 4150
.500 LEAD
THREADING TIME - 8 MIN. 18 SECS.
FOCUSING NUT - ALUMINUM
1 IN. DIA. - 16 TPI 8 START
THREADING TIME - 25 SECONDS
CONNECTOR - STEEL C-1117
.75 IN. DIA. - 20 TPI
THREADING TIME - 7 SECONDS
FUEL NOZZLE - AMS-5640
1.040 IN. DIA. - 12 TPI
THREADING TIME - 12 SECONDS
STUD - SAE 4140 - RC-41
.2628 IN. DIA. - 18 TPI
THREADING TIME - 12 SECONDS
SCREW - MILD STEEL
1.084 IN. DIA. 1 IN. LEAD - 3 START
THREADING TIME - 64 SECONDS
COUPLING - ALUMINUM
1.9375 IN. DIA. - 10 TPI
THREADING TIME - 11 SECONDS
NOZZLE - AMS-5640
1 IN. DIA. - 28 TPI
THREADING TIME - 6 SECONDS
WORM - MILD STEEL
.9583 IN. DIA. 28 D.P. - 6 START
THREADING TIME - 3 MIN. 20 SECS.
VALVE STEM - BRASS
2 START 10 TPI STUB ACME
THREADING TIME - 23 SECONDS
STUD - TITANIUM
.25 IN. DIA. - 28 TPI
THREADING TIME - 20 SECONDS
LIFT SCREW - STEEL B-1112
1.280 IN. DIA. - 4 TPI
THREADING TIME - 23 SECONDS

CRI-DAN SINGLE-POINT THREADING LATHES

...cut costs with simple single-point carbide tools. They're easily resharpened or replaced. They eliminate expensive upkeep of thread milling cutters or thread grinding wheels.

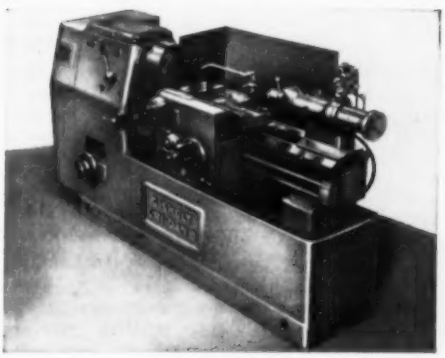
...assure extremely accurate lead and thread form and exceptional finish with low-cost carbide tools on materials that don't allow economical threading by other methods.

...handle any material from titanium or toughest alloy steels to brass and other non-ferrous metals with a wide selection of spindle speeds and feeds to meet all job requirements.

...set up fast to produce single- or multiple-start, coarse or fine, left- or right-hand threads, parallel or tapered with metric or inch pitches—thread up to shoulders on all types of internal and external operations.

...cut costs from start to finish with CRI-DAN's speed, versatility and economy.

Why put off the savings the CRI-DAN method can bring you *right now?* Ask your Gisholt Representative for complete details. Or write us for literature or cost estimates on your particular work.



Two models are available. The smaller Model B (shown) offers extreme flexibility with spindle speeds of from 154 to 2808 r.p.m.; 3′ capacity between centers and 15½″ swing over bed. Rugged saddle supports fast-acting threading slide, easily positioned along bed. Complete change-over from job to job can be made in 15 minutes.

Investigate Gisholt's Extended Payment and Leasing Plans

GISHOLT MACHINE COMPANY
Madison 10, Wisconsin

Turret Lathes • Automatic Lathes • Balancers • Superfinishers • Threading Lathes • *Factory-Rebuilt Machines with New-Machine Guarantee*

Announcement of Major Significance

FOR EVERY USER OF SOCKET HEAD CAP SCREWS

Following exhaustive studies begun in 1954, the socket screw products industry adopted, on April 24, 1959, new dimensional standards for socket head cap screws. Standard Screw Company participated in these studies and concurred in the recommendations approved by leading fastener manufacturers.

Adoption of the new standards, to be known as the "1960 Series", has important implications for every user of socket screws. As a public service Stanscrew will point out these implications . . . not only in relation to its own products, but also to the overall program of the industry.

Differences, Advantages Of New Design

The "1960 Series" has been carefully engineered so there is functional uniformity for all sizes, particularly as it applies to wrenching areas and to the relationship of head diameters to body diameters. For most sizes, as illustrated, this means substantial increases in both head diameter and socket size, and thus provides these advantages over the present design:

1. *Maximum utilization of the fastener's inherent strength . . . larger wrenching area permits application of greater clamping force.*
2. *Increased bearing surface under the head . . . up to 233% more.*
3. *Minimum indentation . . . particularly important with softer metals.*

Should You Convert Now?

Obviously, for many applications, the new design offers important benefits which indicate conversion as rapidly as possible. In some cases, however, existing product design may not accommodate the larger heads . . . or, where socket cap screws are countersunk, revising your countersinking operations may create significant production problems. Stanscrew urges, therefore, that each company learn complete facts on the fastener industry's future plans.

Timetable For Industry Changeover

Stanscrew has already started production of the new "1960 Series". Manufacture of the present (1936) series will continue, however, and they will be available as standard, in-stock items until at least January 1, 1961. At that time, it is now contemplated the "1960 Series" will become the accepted standard throughout industry and the "1936 Series" will then be furnished only when specifically ordered.

When Designing A New Model

For products now on the drawing board, this timetable indicates many manufacturers should plan to use the "1960 Series" as the standard for later production. By making such design provisions, you assure maximum acceptance and minimum difficulty in the future.

For Existing Products

For many existing applications, where socket cap screws are not countersunk, either the 1936 or the "1960 Series" may be used. In frequent cases, improvements of the 1960 design suggest conversion within a short period. In other applications, where the heads are countersunk or where the greater head diameters of the "1960 Series" create a problem, changeover should probably be postponed until a general redesign of your product is scheduled.

Special Stanscrew Marking

To further distinguish its "1960 Series", Stanscrew will knurl heads of all new style socket cap screws with a split herringbone design (as shown). This special marking and the new "1960 Series" box labeling will provide quick identification of these quality fasteners.

For Further Information

Your Stanscrew distributor has the latest facts on the new "1960 Series" and will be happy to discuss them with you. If desired, he also will arrange for a prompt visit from a Stanscrew fastener specialist who will be most happy to go over all aspects of this new industry program as it regards your own particular operation.

Stanscrew also has a new brochure which provides complete dimensional and design data on the "1960 Series". No obligation, of course, for your copy.

STANSCREW FASTENERS

CHICAGO | THE CHICAGO SCREW COMPANY, BELLWOOD, ILLINOIS
HMS | HARTFORD MACHINE SCREW COMPANY, HARTFORD, CONNECTICUT
WESTERN | THE WESTERN AUTOMATIC MACHINE SCREW COMPANY, ELYRIA, OHIO

STANDARD SCREW COMPANY 2701 Washington Boulevard, Bellwood, Illinois

SHEFFIELD ELECTRONIC INSTRUMENTS ASSURE HIGHER PRECISION IN YOUR GAGE LABORATORY

ACCUTRON COMPARATOR

Amplifications (Dual): 1000/2000, 2500/5000, 5000/10000, 10000/20000, 20000/40000.
Vertical capacity: 5¼".
Gaging pressure (oz.): 2—4—8—16—40.

ACCUTRON LEADCHEK

Amplifications (Dual): 1000/2000, 2500/5000.
Capacity: 10" dia.—36" long. Micrometer dial graduated to "tenths".

ACCUTRON GAGE BLOCK COMPARATOR

Amplifications (Dual): 10000/20000, 20000/40000, 50000/100000. Capacity: 0"—4".
Gaging pressure (oz.): 2—4—8—16—40.

ACCUTRON INTERNALCHEK—MODEL N-7

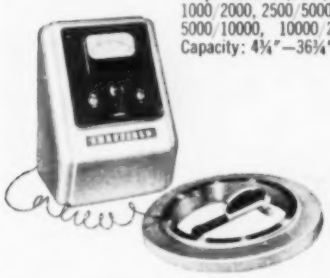
Amplifications (Dual): 1000/2000, 2500/5000, 5000/10000.
Gaging dia.: .370"—12".
Gaging depth: 1½".

ACCUTRON RING CHECKING INSTRUMENT

Amplifications (Dual): 1000/2000.
Min. size of work: 1" ID. Depth: 5½".

ACCUTRON INTERNAL DIMENSION GAGE

Amplifications (Dual): 1000/2000, 2500/5000, 5000/10000, 10000/20000, Capacity: 4¼"—36¼".

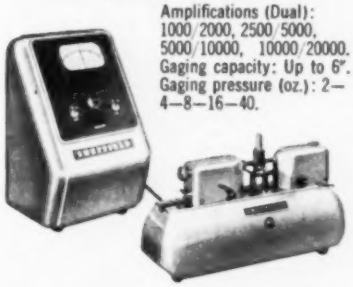


ACCUTRON AMPLIFIER AND ELECTRO-JET PICK-UP UNIT

Amplifications (Dual): 1000/2000, 2500/5000, 5000/10000, 10000/20000, 20000/40000, 50000/100000.

ACCUTRON HORIZONTAL EXTERNAL COMPARATOR

Amplifications (Dual): 1000/2000, 2500/5000, 5000/10000, 10000/20000.
Gaging capacity: Up to 6".
Gaging pressure (oz.): 2—4—8—16—40.



ACCUTRON HEIGHT INDICATOR

Amplification (Dual): 1000/2000, Vertical range: 0"—26".

For Detailed Information **on any of these instruments, write to the Sheffield Corporation, Dayton 1, Ohio, U.S.A., Dept. 1.**

MICRO-HARDNESS TESTER

Vertical capacity: 2⅜".
Vice capacity: 1 1/16".
Microscope magnifications: 200 x and 400 x.

the **SHEFFIELD** *corporation*

of Bendix Aviation

manufacture and measurement for mankind

7715

4,769 years to arrive ACCURATE HYDRAULIC

122 out of 124 hydraulic press brakes in U.S. aircraft industry are PACIFIC

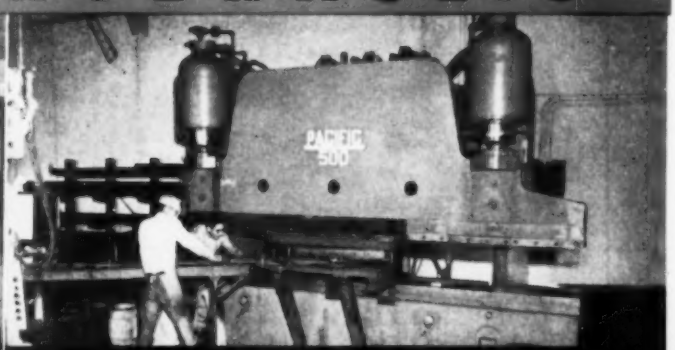
Aircraft manufacturers work to the closest tolerances of all industries in metal forming. Douglas Aircraft Company, Tulsa, Oklahoma, with 8 Pacific Brakes (above) is typical of the airframe manufacturers who have selected Pacific for its precise accuracy.

924 PACIFIC Brakes, representing over 95% of all hydraulic press brakes in use today, have operated for an aggregate of 4,769 years to test and confirm PACIFIC designs that have established hydraulic press brakes as far more profitable to operate than mechanical brakes. However, only PACIFIC has precise accuracy, versatility, high speed and dependability that comes from years of experience in manufacturing, developing and improving this unique machine. It is the only hydraulic press brake in daily operation that is actually air bending, straightening, deep drawing, blanking, and doing heavy punching. Accuracy within thousandths of an inch (greater than with any mechanical or other hydraulic brake) repeats itself on every stroke. Ram remains level regardless of location of work on the bed. PACIFIC sizes range from 60 tons to 1500 tons.

PACIFIC HYDRAULIC

Only hydraulic brake built for HEAVY PUNCHING

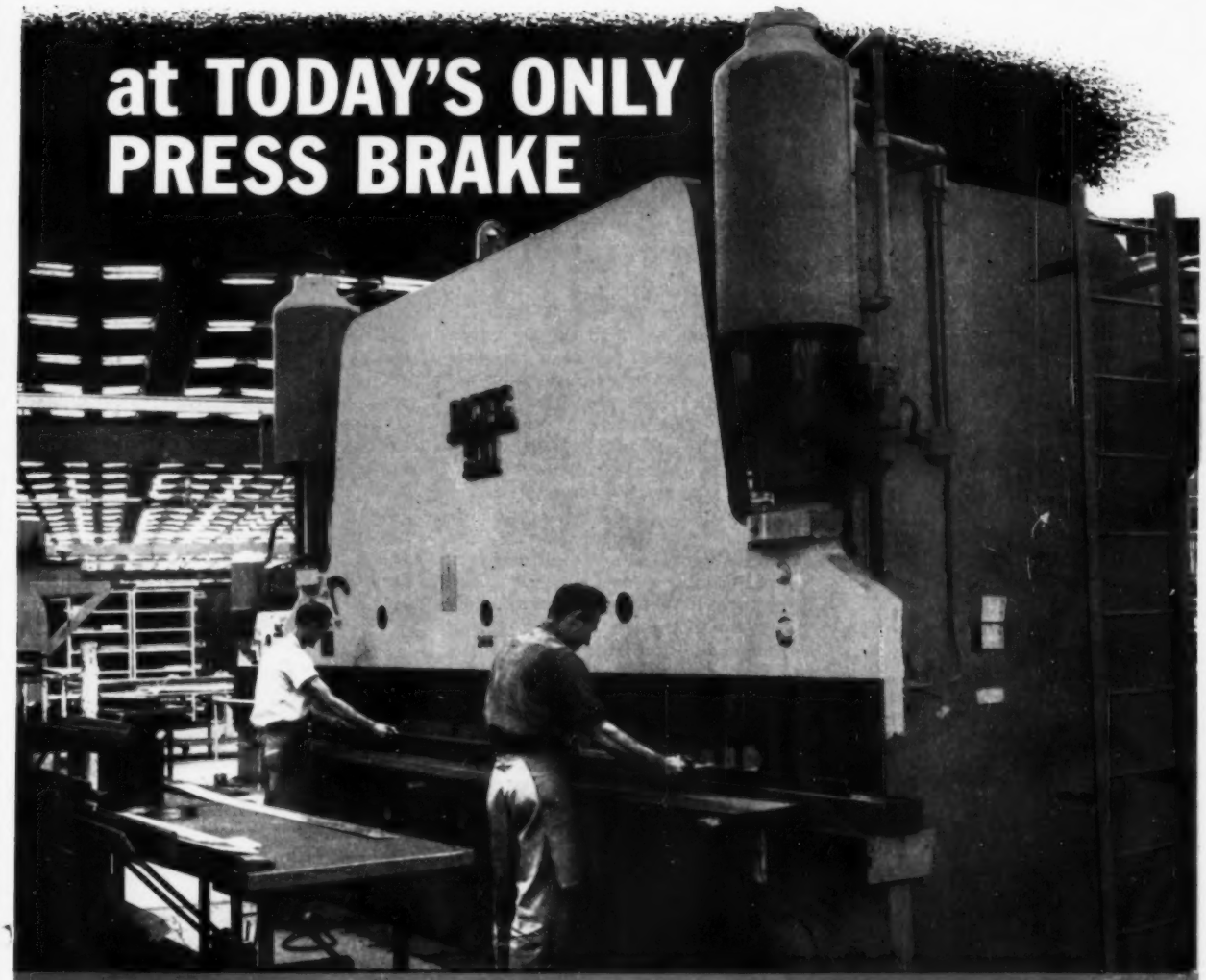
Pacific is uniquely designed to absorb heavy shock from punching in the hydraulic system rather than in the frame of the brake. Cushioned against shock, punch and dies stand up from 3 to 8 times longer than with mechanical brakes. Photo (above) shows 1" alloy steel plate being punched at earthmoving equipment plant.



MAINTENANCE-FREE for years

Dependable, simplified electrical and hydraulic controls can easily be kept working continuously by any plant maintenance crew. There are no complicated electronic devices. In photo (above) at agricultural equipment plant, the 500 ton Pacific Hydraulic Brake shearing ¾" alloy steel plate with Pacific Shearing Attachment has operated continuously for the first 4 years at a cost of $5.22 in replacement parts.

at TODAY'S ONLY PRESS BRAKE



PRESS BRAKE

HIGH SPEED operation

Pacific adjustable stroke length can be shortened for rapid stroking. Automatic, self-leveling ram permits use of progressive dies across entire bed of press. The automatically-fed Pacific at automotive parts plant, which can cycle up to seventy 1½" strokes per minute, is forming 3780 operations per hour in the above photo. In virtually any operation, Pacific's high cycling speed equals or exceeds materials handling capacity.

Write for brochure

PACIFIC INDUSTRIAL MANUFACTURING COMPANY

848 49th AVE., OAKLAND, CALIF.

PLANTS:

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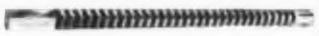
SAVE TIME with STANDARD STOCK BROACHES

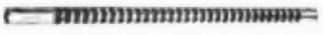
Minute Man
KEYWAY BROACH KIT

In one minute and for as little as one cent you can cut a keyway with this kit. For keyways from 1/16" to 1" in any bore from 3/4" to 3".

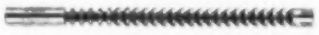
Minute Man



SQUARE BROACHES



HEXAGON BROACHES



New ROUND BROACHES

Used in an arbor or hydraulic press for finishing holes to exact size in *one pass*. 1/8" to 3/4" squares and hex's; 3/4" to 1" rounds. Production Type Keyway Broaches also in stock.

duMONT TOOL BITS
hold a keener cutting edge longer

An almost perfect balance of *wear resistance*, *toughness* and *red hardness* gives duMont Tool Bits a definite edge in cutting life, gives you more cuts per bit, more cuts per dollar.

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Letters...

To American Machinist
330 W 42nd St, NY 36, NY

Value analysis in Ordnance

Dears Sirs:
As Watervliet Arsenal was the first installation in the Ordnance Corps to adopt the Value Analysis Program, with a considerable degree of success, your Special Report, "The Impact of Value Analysis" (*AM*—July 13 '59, p117) was of extreme interest to our Value Analysis Group.

This program at Watervliet Arsenal was inaugurated in June 1956 with one man working as a full-time value analyst. Since then we have enlarged to the point where our Group consists of four full-time value analysts and one stenographer. To date this Arsenal has approved projects totaling $375,000 in savings on currently procured items.

Two of our people were trained at General Electric seminars, one at a Bureau of Ships seminar, and one at an Ordnance-wide seminar which was conducted by the Value Analysis Staff at Watervliet Arsenal.

This staff has conducted one in-plant seminar and two Ordnance-wide seminars, with the assistance of speakers from both Government and Industry, in which a total of 111 people were trained. These people were representatives from 14 Ordnance activities, two Naval installations, and three private contractors.

The value analysis program was approved for use throughout the Ordnance Corps by the Chief of Ordnance in May 1958 and was established as mandatory in Sept 1958.

Other Ordnance installations having a program already established are the Army Rocket and Guided Missile Agency, Frankford Arsenal, and Springfield Armory.

FOR THE COMMANDER:
A D Mosher, *assistant*
Watervliet Arsenal
Watervliet, NY

Sequence control for spots

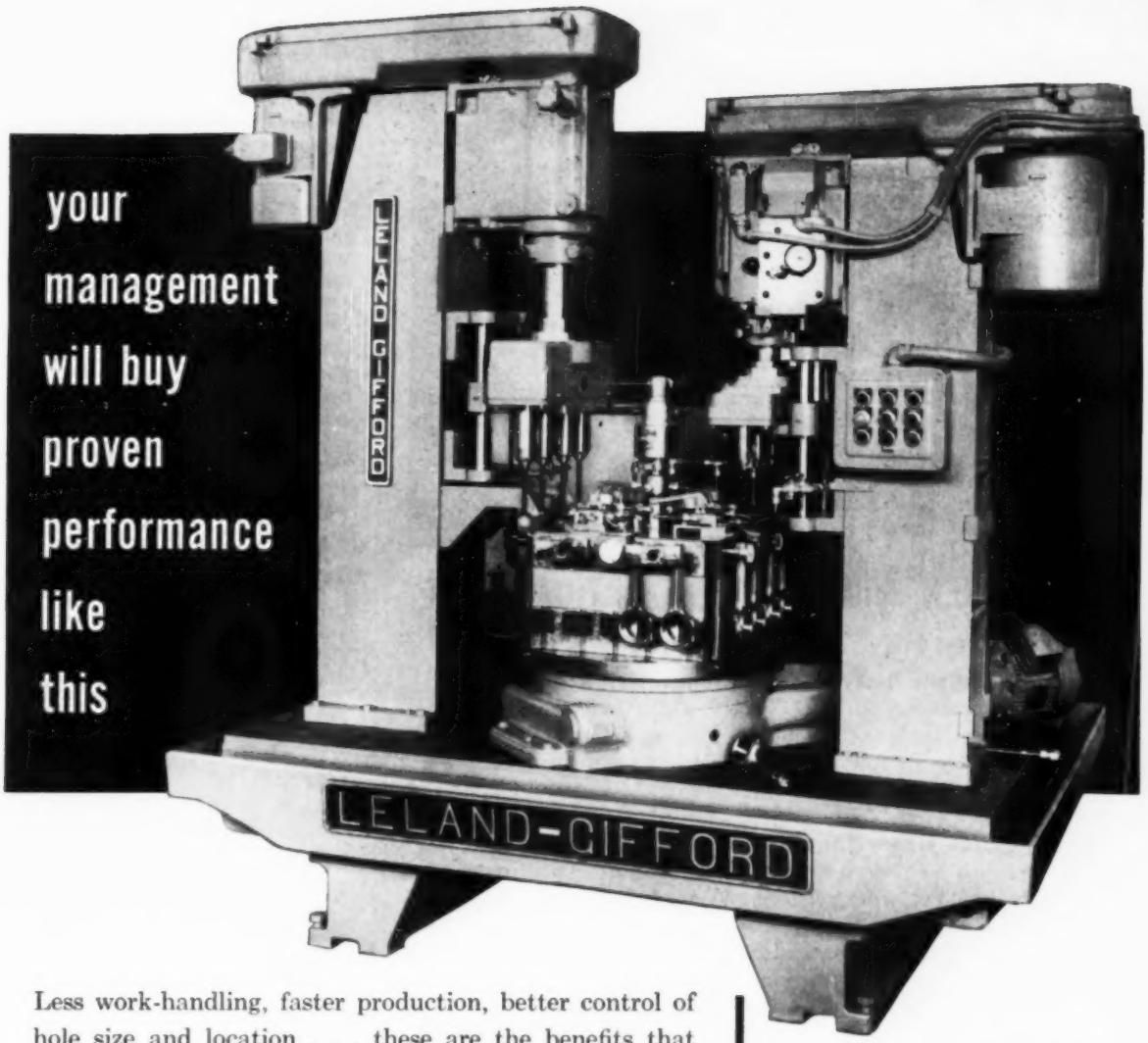
Dear Sirs:
In your "Metalworking Report" section you carried an interesting item entitled "More Spots; Same Power Supply" (*AM*—June 15 '59, p3). The article indicated that Instrument Control Co of Minneapolis has installed a master welding-machine controller that prevents overlapping of firing

SHOPMATES

N. Jarvis

WHO WORKED LAST NIGHT ?? I HAD THAT LATHE ALL CLEANED UP!! GUYS SNEAKIN' AROUND WORKIN' OVER-TIME ... WHASSAMATTER ?? I GOT MUMPS OR SOMETHIN' ??
I HOPE THEY DO CALL HIM IN THE NEXT TIME ... I WORKED HALF THE NIGHT ON A GADGET FOR SOME BIG SHOT'S CLUB AND THEY GIVE ME A VISITOR'S PASS!!
N. JARVIS

your management will buy proven performance like this



Less work-handling, faster production, better control of hole size and location . . . these are the benefits that quickly justify investment in Leland-Gifford special drilling machines. We will gladly work up your rough notes into a fully developed proposal and supply the facts and figures you need to sell management on your suggestions for better precision drilling methods.

For automatic drilling at its best be sure to see Leland-Gifford

CALL THE OFFICE NEAR YOU

THE JOB: Drill ½" oil splash hole and $\frac{5}{16}$" metering hole in connecting rod.

THE MACHINE: A Leland-Gifford two-unit special with one No. 4 and one No. 3 self-contained drilling unit. Index table is loaded with four parts in each station and clamped by hydraulic clamp cylinders. Four-spindle multiple head at left station drills splash holes to depth; directed air jets at rear station clear chips, four-spindle head at right station drills metering holes. Production of 620 pieces per hour is easy at 100% efficiency.

LELAND-GIFFORD SPECIAL DRILLING MACHINES

WORCESTER 1, MASSACHUSETTS
U. S. A.

Chicago 5
2515 W. Peterson Ave.
Detroit
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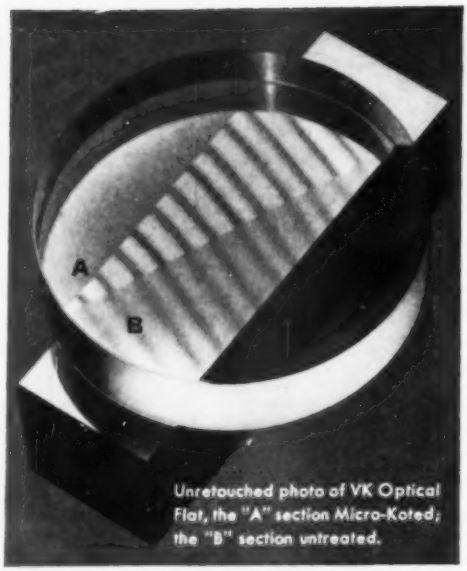
Cleveland 22
P. O. Box 853
New York Office
75 S. Orange Ave.
South Orange, N.J.
Los Angeles Office
2620 Leonis Blvd.
Vernon 58, Cal.
Indianapolis 6, P. O. Box 1051
Rochester 12, P. O. Box 24, Charlotte Station

Checking surface flatness **down to 1/10 of a band?** (.000001-inch) You can do it easily with the



Unretouched photo of VK Optical Flat, the "A" section Micro-Koted; the "B" section untreated.

VAN KEUREN MICRO-KOTED* OPTICAL FLAT

Elimination of the fuzzy edges of the interference bands gives you *greater precision* and *readability*... and faster checking, too, because you get the pattern quicker. There's stronger contrast, a brighter field. The narrow band, very black and sharp-edged, has a width corresponding to a height difference of about .000001".

Having several times the effectiveness of ordinary flats, you might think that VK Micro-Koted Optical Flats are expensive — but that's where you'd be wrong. They cost only 10% to 15% more than uncoated flats. They do not require special handling; they have amazingly long life. One user checked more than 10,000 pieces of permanent magnetic material (carbon seals and Alnico seals) without any appreciable wear. Speaking of VK Micro-Koted Flats, one man said, "It makes a hell of a difference! We wouldn't buy a flat *unless* it was Micro-Koted!" That's the kind of compliment that makes us do our best!

Originated by Van Keuren in 1957, these Micro-Koted flats are perfect for checking bronze, brass and other metals used for magnetic seals, and for checking other critical parts, for surface flatness.

Write today for descriptive leaflet, "Micro-Koted Flats".

* VK Micro-Koted Optical Flats are treated on one side with a transparent layer of hard metal.

VK

THE Van Keuren CO.
Since 1920
173 Waltham Street, Watertown 72, Mass.
PRECISION MEASURING TOOLS
... rated the world's most accurate
Plug Gages · Measuring Wires · Optical Flats and Light Wave Equipment · Gage Blocks · Precision Lapping Service and Parts

times and thereby eliminates voltage drops.

We are interested in obtaining more information on the subject but have been unable to find the address of Instrument Control Co.

Donald G Stallman
Seattle, Wash

Dear Sirs:
What is the address of Instrument Control Co of Minneapolis?

A Guzinski
San Diego, Calif

For additional information on this equipment, write to Mr W J Whitbeck, Instrument Control Co, 1554 Nicollet Ave, Minneapolis 3, Minn—Ed.

More on clutch sprags

Dear Sirs:
On your "Materials" page (*AM*—June 29 '59, p71), we read of chrome-treated clutch sprags manufactured by Formsprag Co in cooperation with Chromalloy Corp. Would it be possible for you to give us the addresses of these companies?

W Hamburger
Toronto, Ontario

Dear Sirs:
I am very interested in the Chromallizing process and would like to know where I can get full information about it.

J A Cunningham
Lafayette, Ind

The Chromalloy Corp, 450 Tarrytown Road, White Plains, NY, can supply information about Chromallizing. The sprags are manufactured by The Formsprag Co, 23601 Hoover Road, Warren, Mich—Ed.

ELECTRONICS INC.

"Parker there pioneered in the early days of television. He was a bartender."

CALENDAR

Pressed Metal Institute—National Meeting, Sept 13-17, Stanley Hotel, Estes Park, Colo.

Society of Automotive Engineers—Farm, Construction, and Industrial Machinery Meeting and Display, Sept 14-17, Milwaukee Auditorium, Milwaukee, Wis.

American Die Casting Institute—Annual Meeting, Sept 15-17, Edgewater Beach Hotel, Chicago, Ill.

Instrument Society of America—Instrument-Automation Conference & Exhibit, Sept 21-25, Int'l Amphitheater, Chicago, Ill.

American Welding Society—National Fall Meeting, Sept 28-Oct 1, Sheraton-Cadillac Hotel, Detroit, Mich.

Society of Automotive Engineers—National Aeronautic Meeting and Display, Oct 5-10, Ambassador Hotel, Los Angeles, Calif.

American Society of Tool Engineers—Semi-annual Meeting, Oct 8-10, Chase-Park Plaza Hotel, St Louis, Mo.

American Society for Testing Materials—Pacific Area National Meeting, Oct 11-16, Sheraton Palace Hotel, San Francisco.

Magnesium Association—Annual Convention, Oct 19-20. Hotel Roosevelt, New York, NY.

American Institute of Electrical Engineers—Machine Tool Conference, Oct 19-21, Sheraton-Cleveland Hotel, Cleveland.

National Safety Council—National Safety Congress, Oct 19-23, Hilton, Congress, Sheraton, Morrison & LaSalle Hotels, Chicago.

American Machine Tool Distributors Association—Annual Meeting, Oct 25-27, Statler Hotel, St Louis, Mo.

American Gear Manufacturers Association—Semi-Annual Meeting, Oct 25-28, Edgewater Beach Hotel, Chicago, Ill.

American Society for Metals—National Metal Exposition and Congress, Nov 2-6, International Amphitheater, Chicago, Ill.

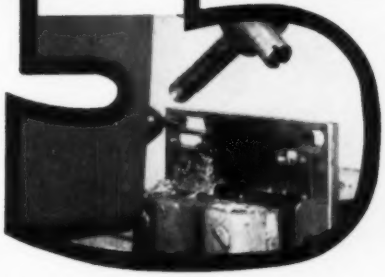
"Standard" B & S 4 flute, ½", taper shank end mill cutting cam track in annealed steel.

How Brown & Sharpe "STANDARD" End Mills End Wonder, Worry & Wait!

"Standard" B & S 4 flute, ⅜", extra long, fast helix end mill peripheral milling vertical slot note: square end and bottoming cut.

"Standard" B & S 2 flute, 1/16", straight shank, double end end mill cutting key slot in arbor—note: double end doubles production before resharpening.

"Standard" B & S 4 flute, ½", fast helix, double end end mill plunge cutting and slotting boiler plate.



CHOOSE FROM 1065 DIFFERENT "STANDARD" OFF-THE-SHELF END MILLS AND PRODUCE JOBS LIKE THESE—IN THE TIME YOU USED TO WAIT FOR OTHER TOOLS!

Here are just a few of the production jobs that are completed and shipped daily—ahead of schedule—by Brown & Sharpe End Mill Users.

Rely on your Brown & Sharpe Distributor for speedy service from a stock of 1065 different end mills.

Send for the B & S "Condensalog" to: **Cutting Tool Division, Brown & Sharpe Mfg. Co., Providence 1, Rhode Island.**

Brown & Sharpe

CUTTING TOOL DIVISION

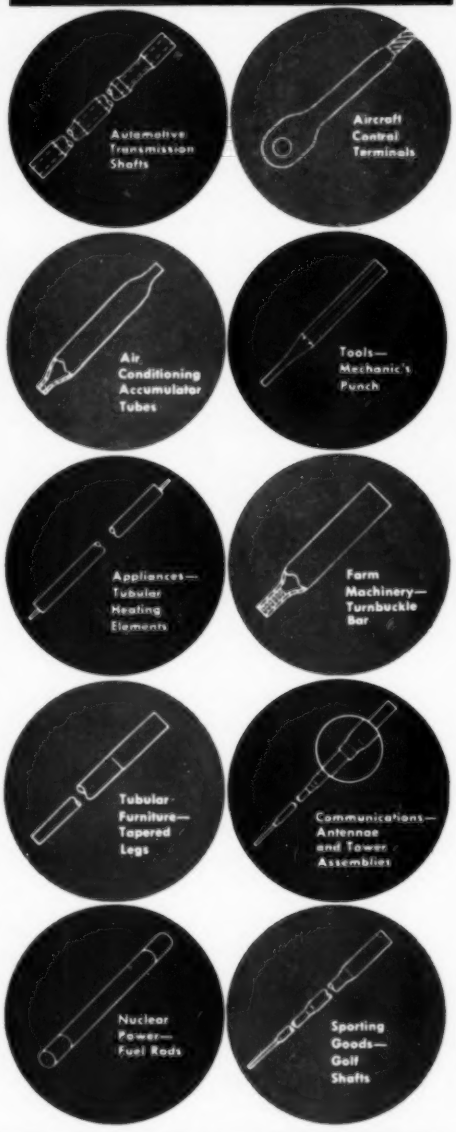
HIGH SPEED STEEL CUTTERS
NELCO CARBIDE TOOLS
END MILLS

B·S

FOR THAT EXTRA EDGE IN PRODUCTION

INDUSTRIAL DISTRIBUTORS · THE RIGHT HAND OF PRODUCTION

WHAT TORRINGTON ROTARY SWAGING MACHINES CAN DO FOR YOU



These versatile, efficient machines shape metal parts by hammering between dies instead of cutting stock away. They give you a full pound of parts from every pound of metal. They also save you time and labor. Swaging is usually the fastest way to point, taper, reduce or bond metal parts. Tooling is simple and surprisingly inexpensive.

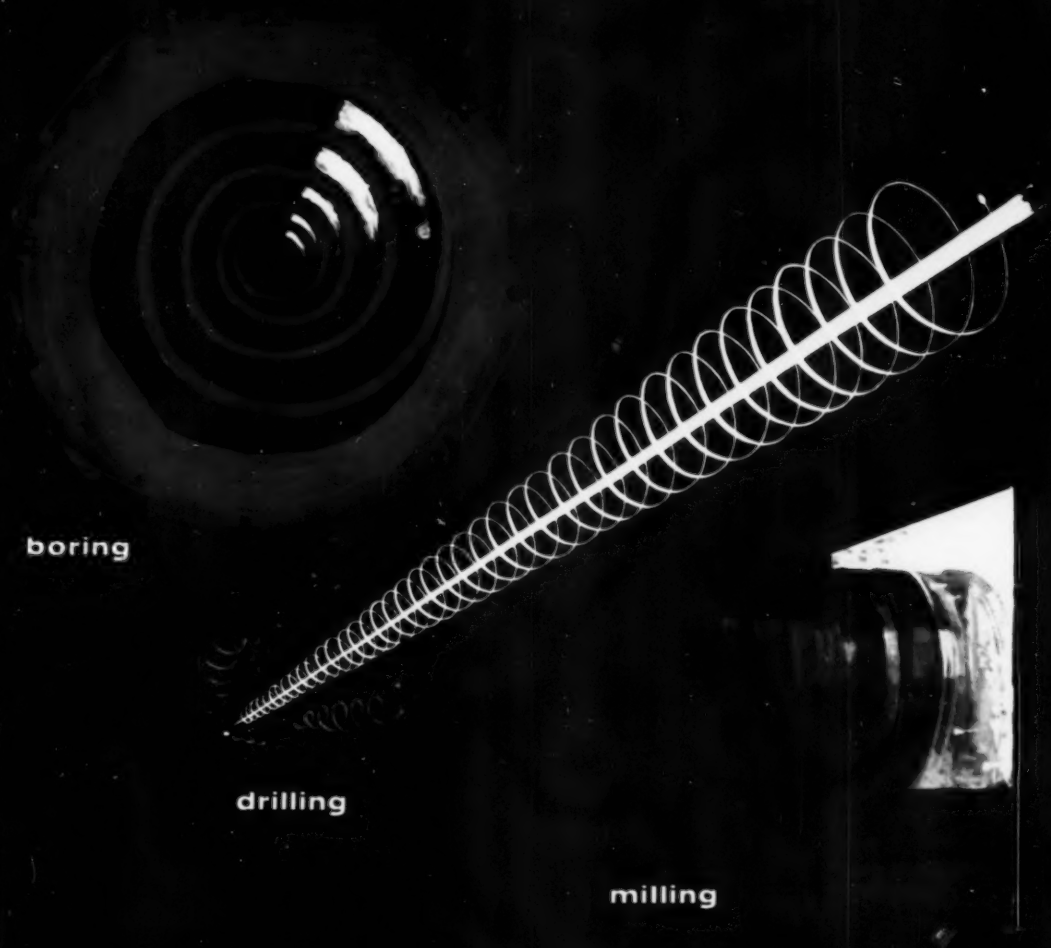
There is no greater authority on swaging than Torrington. Torrington pioneered the swaging process, designed the original equipment and has constantly improved it through innovations in methods and engineering. Today, Torrington operates more swaging machines than any other company in the world. The experience of our engineers is unparalleled. We maintain experimental shops to help you solve your special swaging problems. If you have a part that can be swaged we can design and produce "Job-Tested" dies to your specifications. Come to Torrington with your swaging problems—we have the answers. The Torrington Company, Swaging Machine Division, 200 North St., Torrington, Conn.

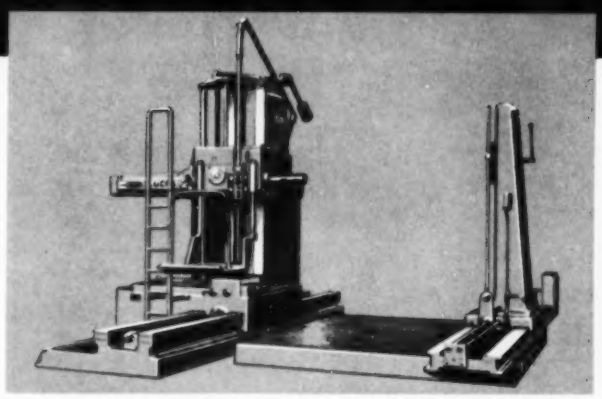
TORRINGTON ROTARY SWAGING

SWAGING HEADQUARTERS, U.S.A.

CIRCLE 207 READER SERVICE CARD

CIRCLE 208 READER SERVICE CARD ►

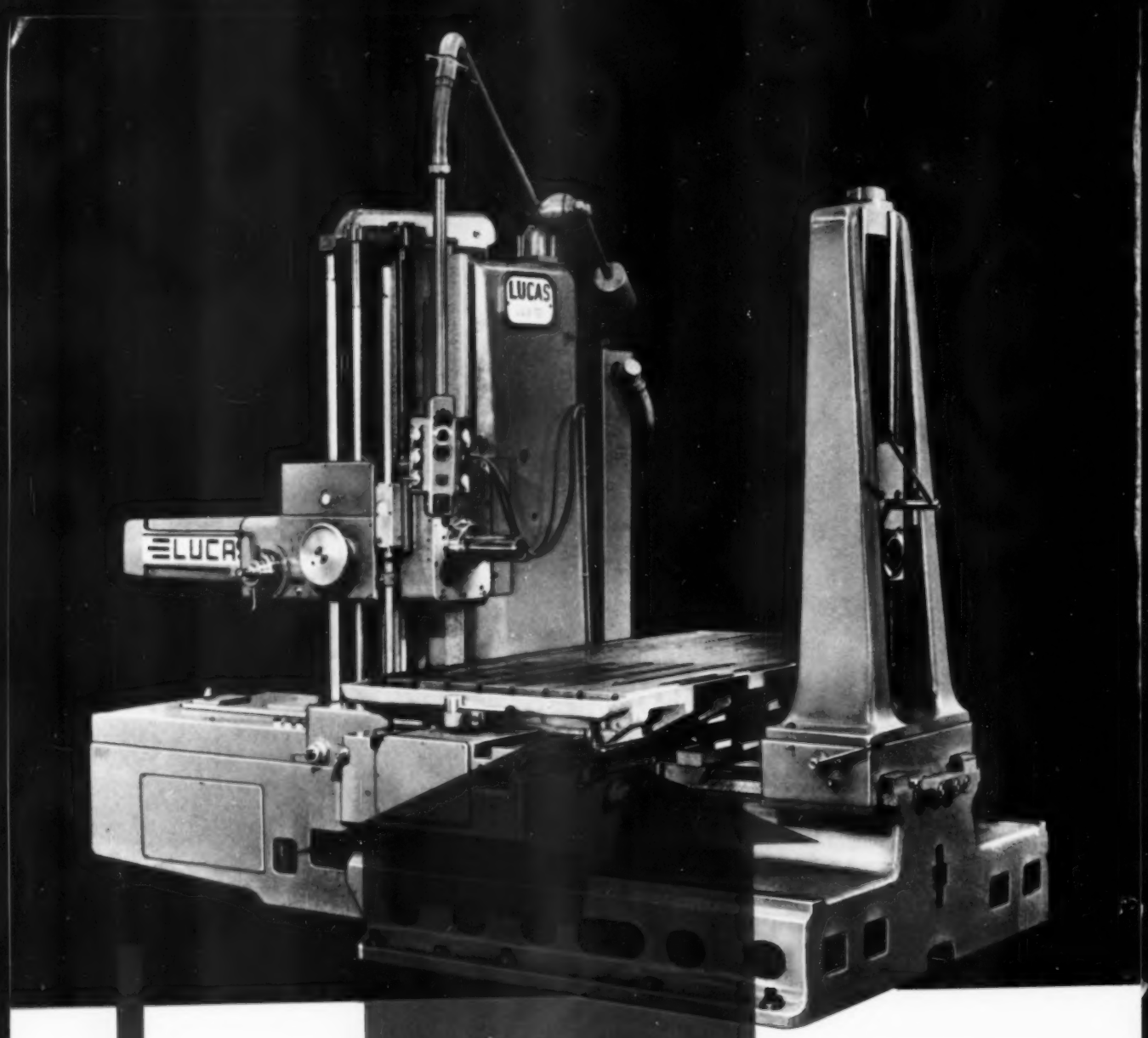




Floor type machines YES!

A complete line of floor-type, horizontal boring, drilling and milling machines in the 4" and 5" spindle diameter range . . . with all the features and controls available in other Lucas models. Many of these are to be found *only* in a Lucas. *Did you ever meet a man who regretted picking a Lucas?*

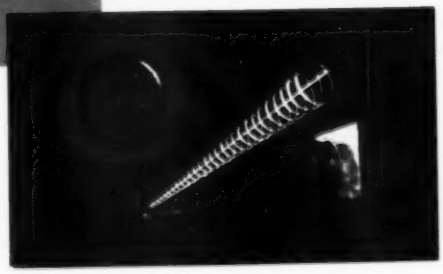
LUCAS
OF CLEVELAND



AIR LIFT*

to saddle and table

All Lucas components are fitted with the utmost precision. To insure lifetime accuracy, the saddle and table ride on lubricated compressed air . . . *ever so slightly above the surface of the ways.* Traverses, either feed or rapid, are silk-smooth and free of wear.



*Patent Pending

LUCAS
OF CLEVELAND

SPOT NEWS...

- **Some Russian metalworkers are already on seven-hour shifts** and all Russian industry will be on seven-hour shifts by 1961. Eventually, according to Eugene Unksov, director of Moscow's Central Scientific Research Institute of Technology, some metalworkers will be on four-hour shifts.
- **$4-million worth of machine tools and equipment** are going on the auction block at Fairchild Aircraft's Deer Park, LI, plant August 24-28, along with private sale of manufacturing rights to its J-44 turbojet engine and V-32 auxiliary power unit. (see p67).
- **West Coast machinists and other shipyard metalworkers** are asking, through the International Association of Machinists, for a 24¢-an-hour wage increase package: 7¢ retroactive to July 1, 7¢ more effective July 1, 1960, and 10¢ an hour for a trust fund effective May 1, 1960. Current hourly wage of West Coast machinists: $2.73 with benefits.
- **Cars that travel on air** will be produced by Curtiss-Wright Corp's South Bend, Ind, plant beginning in November. The 300-hp, 2-engine, 4-passenger cars will be offered to industry rather than the public at first. The car will travel up to 60 mph, 6 to 12 inches off the ground.
- **One machine tool leasing firm reports its business has tripled** this year over 1958 levels.
- **Imports of foreign steel,** largely because of the opening of the St Lawrence Seaway, have gone up nearly 25% this year.
- **Early in 1960, France's Renault will introduce a front-wheel-drive,** light-duty truck here—probably in four body styles: panel truck, panel truck with raised roof, pickup and eight-passenger bus, all with 82-hp engines.
- **It's rumored around Detroit** that production will start soon on a turbine-powered truck. Some tooling is said to have been ordered.
- **Used machinery will be auctioned by closed-circuit television** at the forthcoming sale of used aircraft forging equipment at General Electric's Lynn, Mass, plant, September 23. The auctioneer, Industrial Plants Corp, will beam the auction over a closed circuit to bidders in Boston and Chicago. This will be followed by a government auction over a six-city closed circuit on October 7, emanating from supply depots in Philadelphia; Shelby, Ohio; and Granite City, Ill.
- **Zirconium gage blocks in 20 sizes,** ranging from 0.100 to 0.350 in., have been produced for Olin-Mathieson Chemical Corp by Fonda Gage Co, Stamford, Conn. They'll act as masters for ultrasonic gages.
- **Red China is now in production on a 16-spindle vertical drilling machine** and an 18-spindle horizontal drilling machine.
- **Austin and Morris cars will be produced in Italy** under an agreement between British Motors Corp and Innocenti of Milan. First models scheduled for production: Austin A40's and A55's and the Morris Oxford, all with styling by Italy's Pinin Farina.
- **Joint research into metal fatigue** will be conducted by the U S, Canada and nine European countries. About 12,000 test specimens of 20-24 ST light alloy steel and 35 CD 4 chrome moly steel will be damaged at selected stress levels, then stress-cycled to failure. National Bureau of Standards will test about 1000 of the specimens.
- **GE will spend $1 million and two years** to produce "a missile part of unprecedented reliability" at its Irmo, S C, plant. The object: to produce capacitors with a failure rate of 1 in 100,000. Current failure rate for such parts is 1 in 1000. They'll be used in missiles.

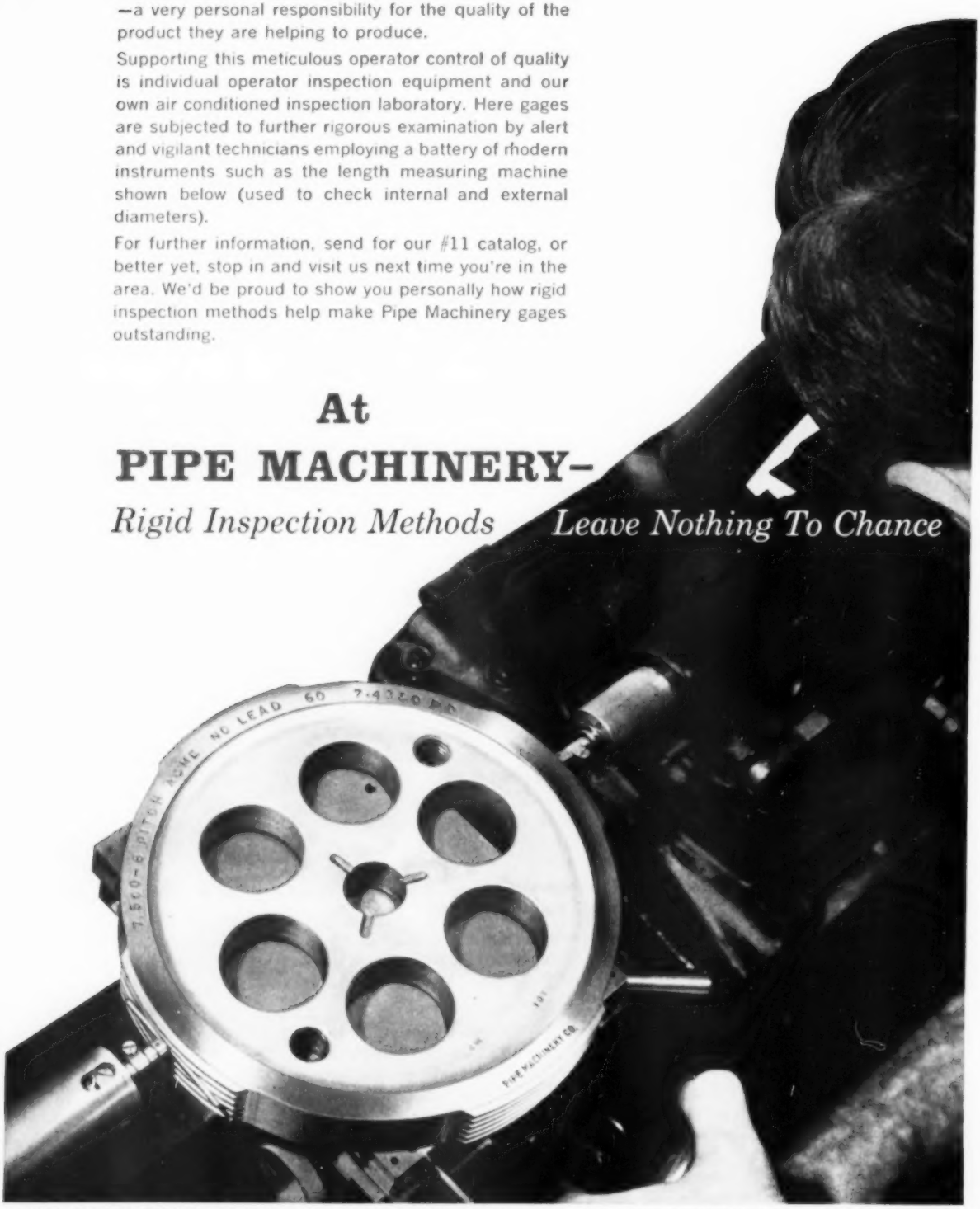
Through each and every stage in the manufacture of a Pipe Machinery gage, our operators feel a very real —a very personal responsibility for the quality of the product they are helping to produce.

Supporting this meticulous operator control of quality is individual operator inspection equipment and our own air conditioned inspection laboratory. Here gages are subjected to further rigorous examination by alert and vigilant technicians employing a battery of rhodern instruments such as the length measuring machine shown below (used to check internal and external diameters).

For further information, send for our #11 catalog, or better yet, stop in and visit us next time you're in the area. We'd be proud to show you personally how rigid inspection methods help make Pipe Machinery gages outstanding.

At PIPE MACHINERY–

Rigid Inspection Methods Leave Nothing To Chance



THE PIPE MACHINERY COMPANY • 29100 Lakeland Boulevard • Wickliffe, Ohio • Greater Cleveland

WASHINGTON...

Wall St. vs Washington . . .

News of the Eisenhower-Khrushchev exchanges of visits got a quick response on Wall St—securities of defense-related companies took a fast dip. Investors reacted as if the outlook for military spending was suddenly changed.

Washington is dismayed by Wall St's reaction. Few if any here — certainly no one connected with the formulation of the defense budget—expect any hard and fast developments to come out of the White House-Kremlin talks which could affect the rate of military expenditures.

Washington's requirement is still an enforceable, inspectable disarmament agreement, before any serious thought can be given the idea of trimming defense spending. The Russians have yet to give any sign of going along on such a disarmament scheme, and the diplomatic experts anticipate no change with Khrushchev's visit here.

Pentagon Outlook . . .

"I think that one of the things we must guard against," says Defense Secretary McElroy, "is the natural inclination of this country to believe that peace is just around the corner because there may be the initiation of what I think is fine to have happening. Nevertheless, this is only the first in a series of steps that must be taken before there can really be an acceptance on the governmental policy level of an actual reduction of world tension."

The outlook for defense expenditures in the near future is still fairly clear: A leveling-off in total outlays at around $41-billion a year.

To hold to this sum, however, there'll be wide-ranging cuts and cancellations in selected projects now considered marginal from a strategic viewpoint. That's what's involved in the B-58 and boron fuel cuts.

Pentagon officials are upset that such cutbacks are taking place while the Khrushchev visit is in the works. They're worried that this unusual coincidence is being misinterpreted in some places—in Wall St, for instance. They go out of their way to stress that these cuts and upcoming ones have nothing to do with any alleged changes in the international situation.

Outlook for ex-brass . . .

No important restrictions are expected to come out of the Congressional furore over the hiring of retired military brass by large defense contractors.

Present rules forbid the retired officers from "selling" to the military. Most if not all the big military names are not in direct sales jobs, defense industry spokesmen are saying, but are hired for their technical talents.

Some lawmakers are pushing for new restrictions to spell out what "selling" constitutes and to bar the brass from industry contact with military projects for which they were "directly responsible" while still in uniform.

But such new curbs—even if enacted—are unlikely to discourage the trend in defense industry employment of retired military brass. As has been brought out in the Congressional hearings: Industry needs the skills and background the brass have in order to develop and design new military hardware.

Most of the ex-brass are young enough and willing enough to keep on working even though military retirement rules force them out of uniform.

Ban on machine imports lifted . . .

The Post Office has removed the ban on purchases of foreign-made office machinery. The restriction was ordered last year.

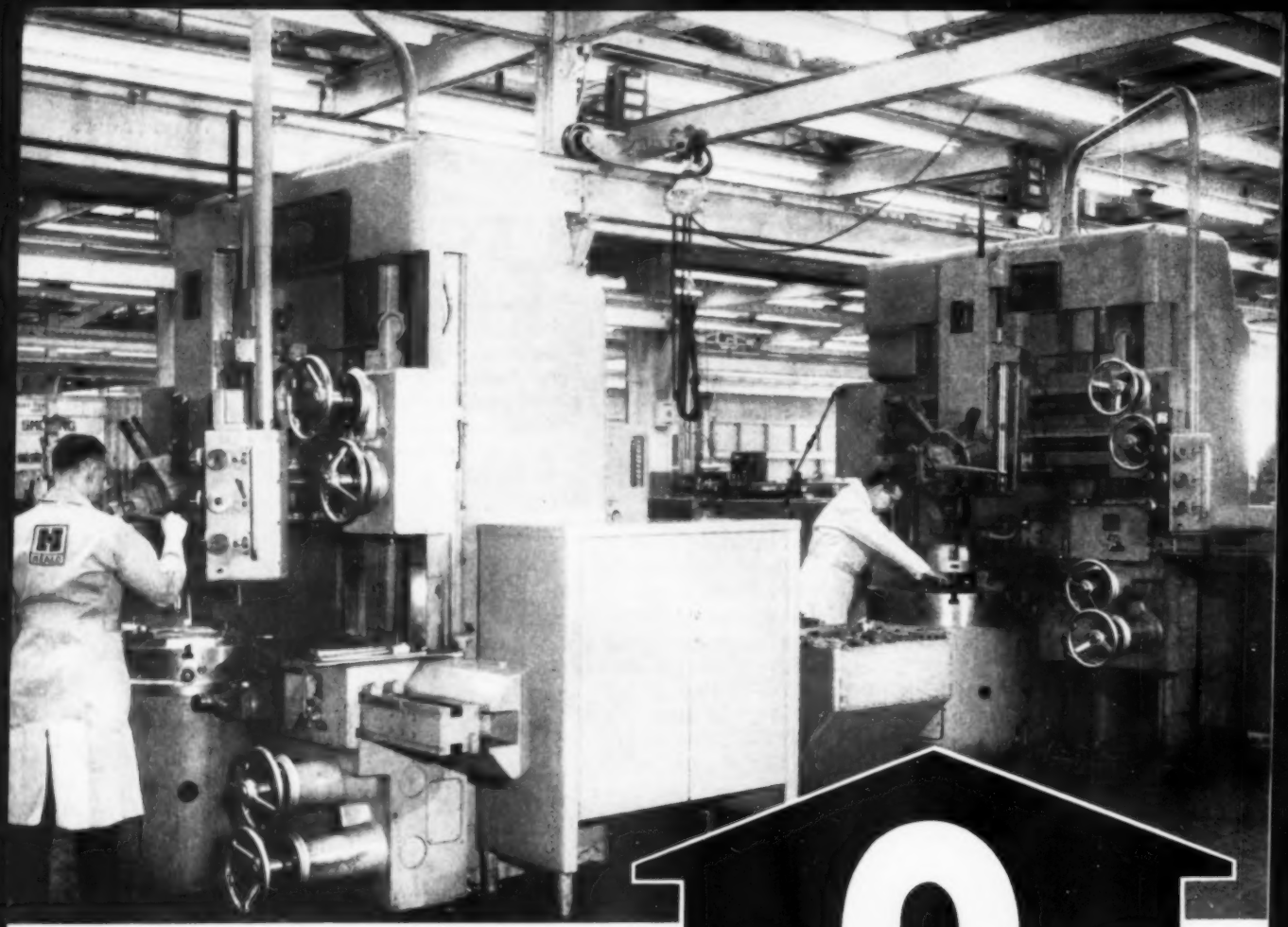
In lifting the ban, the Post Office stresses that in considering purchases of foreign-made office machinery it would have to give "full consideration . . . to repair and service facilities."

The importers still face, of course, the conventional 6% price differential favoring domestic producers over foreign competitors under the government's "Buy American" policies. The price differential is boosted to 12% in cases where the U. S. manufacturer competing for the order has a plant located in a labor surplus area.

Fringes rise, wages hold . . .

Industry has held wage boosts down to 9 to 10c an hour on the average this year, but labor has scored major successes in garnering new fringe benefits which will add to the upward pressure of labor costs on prices.

More unions are turning to the expanding area of fringe benefits as employer resistance to wage increases strengthens. Of more than 500 wage contracts negotiated in the first half of this year, close to 75% of the settlements contained liberalization and increases in fringe benefits that could add several hundred million to wage costs annually.



IT PAYS TO REPLACE . . .

A study of the production factors at The Heald Machine Company, Worcester, Mass., pioneer New England builders of precision machine tools, indicated that two Bullard Cut Master V.T.L.'s, Model 75, would produce as many parts, in any given period, as four Bullard V.T.L.'s of an earlier design.

when 2 do the work of four

In actual production, these additional advantages have been experienced:

- Greater flexibility for faster changeover and set up
- Ease of control — less operator fatigue
- Dependability and accuracy on holding size
- Less tool wear, spoilage and inspection
- More rigidity for higher speeds and feeds

This all adds up to more parts at less cost per piece.

Perhaps an analysis, by a Bullard Sales Engineer, of your machining procedures will reveal "hidden savings" for you.

Why not ask him or write.

BULLARD

THE BULLARD COMPANY

BRIDGEPORT 9, CONNECTICUT

CIRCLE 211 READER SERVICE CARD

DETROIT...

Changeover time . . .

Automatic output this month is down at least 50% below July figures because of model changeovers.

About 250,000 cars are expected to come off the production lines by August's end, compared with better than 500,000 units in July.

With most introduction dates crammed into October, this means September will see a dramatic upturn in production as 1960 model cars are rushed to fill showrooms and supply lines to all dealer areas.

At press time, virtually all Chrysler car production had ceased, as had output at Studebaker-Packard, American Motors, Buick and Oldsmobile.

Truck production showed an earlier drop because of changeovers. At July's end, truck output fell 20% from the week before as Chevrolet closed out its 1959 line. Then as August began both Willys and International Harvester closed down for two weeks' annual vacation.

All told, August truck production, like that of cars, was about half of July's total.

Battle against corrosion . . .

Automakers and parts makers are getting more and more corrosion-conscious these days. First evidence of this has been development of acrylic lacquers and so-called "super enamels," which are designed to put a come-Hell-or-salt-water finish on new cars.

Now, a couple of carmakers have gone a step farther—dipping entire car bodies in rust-resistant primer. Chrysler, with its unitized body, will also use a primer dip, but only to a depth of 18 in., not the entire body.

Other approaches to the corrosion problem are being researched, too. Most of them involve metal spraying. It depends largely upon the individual car company whether the company itself or the component supplier does the spraying.

Either way, metal spraying is now being applied to or contemplated for such parts as springs, body nuts and bolts, other fasteners, mufflers, tailpipes, tire rims and brake drums.

Zinc and aluminum are the two most popular sprayed metals at the moment. Sprayed zinc coatings, for instance, provide an excellent anchor for paint. The thin zinc coating itself is relatively inexpensive, but grit blasting of steel surfaces to prepare for it is a bit costly. And paints and primers must be compatible with the zinc.

Experiments indicate metallized aluminum has a surface porosity that provides the best possible base for paint. Tests show that paint applied over heavy coats of aluminum will withstand corrosion for from 10 to 25 years.

But there's a production problem—sprayed metal doesn't dry fast, is also inclined to absorb moisture during the drying period. This points up a need for humidity controls in drying rooms, and it poses the problem of moving sprayed parts at a much slower pace than most carmakers want.

Plastic-to-metal bonding . . .

U S Rubber has licensed Ford Motor Co to use its method of bonding vinyl plastic sheet to metal (*AM*—Aug 10 '59 p 61), which raises some interesting possibilities for exterior car finishes.

Ford, for instance, expects to make its own vinyl and its own steel to come up with a trim.

To date, the process has been licensed to 17 U S manufacturers (including major steel companies) and in 27 foreign countries.

Essentially, this is a method for continuous bonding of metal (including aluminum) to semi-rigid plastic sheet to give the metal an attractive and durable finish before it is formed.

Once the lamination has been completed, the product can be shaped and fabricated by virtually any metalworking technique, including spotwelding, without damaging the plastic facing.

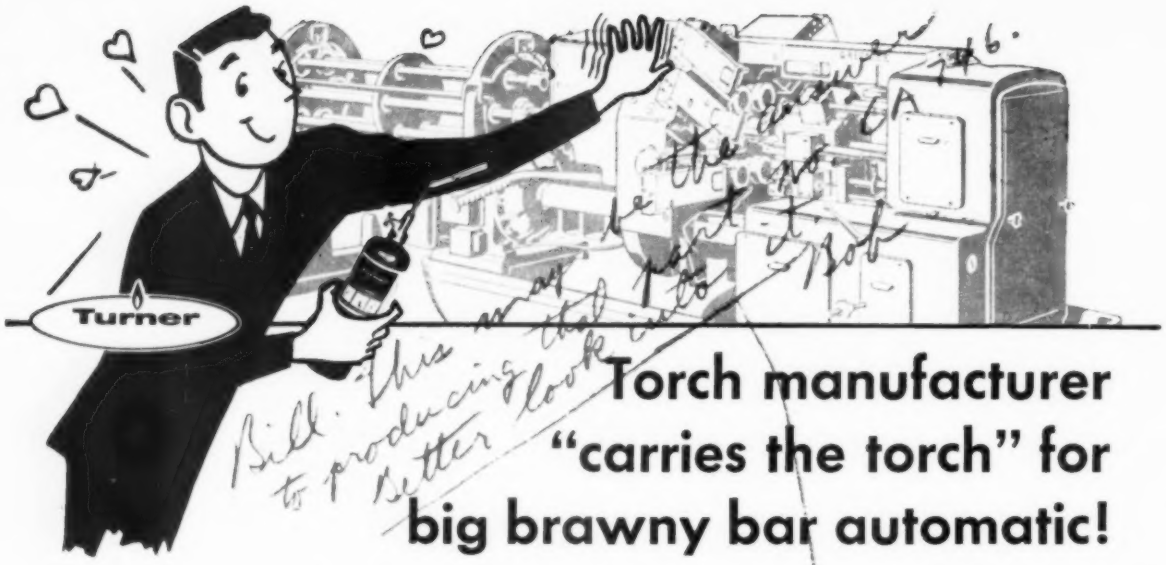
Vinyl-clad steel opens a broad avenue for automotive stylists, according to Ford styling VP George Walker.

Impact of the compacts . . .

If all goes well with introduction of the new U S compact cars on the market by the Big Three, 1960 should see production of just a shade more than 1 million of them.

Best estimates at the moment, projected on a basis of early production scheduling: about 360,000 Chevrolet Corvairs will be produced in the calendar year 1960, along with 240,000 or so Chrysler Valiants, and 420,000 Ford Falcons. Naturally, if sales don't go well these figures will be revised downward and, conversely, if sales skyrocket, production will too.

Meanwhile as the 1959 model year draws to a close, General Motors is turning out about 48% of all U S cars, compared to 55% in 1958. Ford has gained 2.5 percentage points over 1958's 26%. Chrysler has fallen about 1% in its share of the total market. Biggest gainers: American Motors and Studebaker-Packard, who between them have jumped from a 5% share to 9% this year.



Torch manufacturer "carries the torch" for big brawny bar automatic!

Growth of a company from the founder's first fond dream to a leading place in the industry is a matter of continuing product improvement, sound management, ever-increasing efficiency, keeping pace with changing times. Read what a line of machines named Greenlee means to a company named Turner . . . and why, out Sycamore-way, they "just love those Greenlee Bar Automatics" . . .

The Great Fire of 1871 struck and scarred Chicago the very same year that enterprising Edward S. Turner "hung out the shingle" at 4 LaSalle Avenue and proclaimed to one and all that The Turner Brass Works was ready for business.

It's a long way from the Horse Age to the Age of H-Power . . . 1871 to 1959. A whole way of living changed, new products came to the fore. Alert, trend-conscious Turner kept pace with the advancing times, moved the factory to Sycamore, Illinois in 1906 . . . expanded its operations steadily until today the Turner Corporation spans 100,000 square feet of factory space, and turns out products ranging from propane torches to plumbing fixture fittings—blow torches to diesel engine starting aids — camp cook-stoves and lanterns to furnaces and furniture hardware.

Along that route Turner continually met the old familiar problem: *How to get high-speed production and maintain top quality.*

That's where Greenlee enters the picture, and the Case of the Propane Torch is a typical example. It's a "How-They-Dunit" that may hold eye-opening suggestions for some of *your* production problems.

Turner's Propane Torch suddenly became a "hot" item — hot as its glowing tip. An expanding nation-wide need for it in home and shop at length blossomed into an enormous increase in demand. The order went out: "Turn 'em out faster — but keep quality up — keep cost in line." How to do it was the question.

Turner management launched an exhaustive investigation of top-rated production machines on the market. They probed, tested, ran trial runs. Eventually they found a machine that seemed to do everything they asked. It took 9/16" round brass stock, gave it a merry whirl — 298 surface feet per minute on stock diameter—2029 revolutions per minute.

Quality tested consistently high, rejects were held to a minimum, a complete operation was eliminated, as the husky Greenlee Bar Automatics "rolled 'em out" with the tireless gait of a 'round-the-clock marathoner.

That's when a long and happy association began. For shortly thereafter, the Turner P.A.'s signature was on a purchase order for a battery of Greenlee Automatics with special attachments.

A look at the Job Progress schedule will give you an idea of how efficiently they tick off a 6-stage operation on mixer tubes:

1st Position:
The big Greenlee Cam-Feed 1-5/8" Six-Spindle Bar Automatic uses a 1" tool slide stroke with .0063 inch feed on the endworking tools. Stock is fed out to length during indexing, spot-drilled, knurled (using a standard plunge-type knurl holder and a two-roll roller rest)

2nd Position:
The mixer tube is faced by a knee turner while a .277 inch diameter drill, mounted on a high-speed drilling attachment, drills to depth.

3rd Position:
Outside diameter is sized by a standard dovetail form tool. A .187 inch hole is drilled partway, as a two-roll roller rest supports the part.

4th Position:
Using a standard milling attachment mounted on the tool slide, the two parallel flats are milled. (Attachment consists of two milling cutters mounted on a keyed arbor in the milling head). Milling head rotates at the same r.p.m. as the workpiece; internal gearing in the attachment rotates the milling cutters at proper speed for the milling cut.

5th Position:
The .187 inch hole is drilled to depth while a standard cut-off tool breaks down for cut-off.

6th Position:
A 5/16" — 27 thread is tapped, and the part is cut off.

FINAL SCORE:

580 high-quality mixer tubes per hour at gross production rate. One complete operation eliminated. Rejects at an all-time low. . . . No wonder, out Sycamore-way, they "just love those Greenlee Bar Automatics" — big — brawny — and *bears for the jobs where you've got to keep your quality reputation as you keep up with market demand.*

Question:
Have *you* looked into Greenlee, lately, for quality on a production basis?

GREENLEE BROS. & CO.

GREENLEE

1867 Mason Avenue
Rockford, Illinois

AIRCRAFT and MISSILES...

TRENDS

IAM-UAW ready their cudgels...

Next year is going to be a rough one at the bargaining tables for the aircraft industry. Chief reason is that the International Association of Machinists and the United Auto Workers, who between them represent some 600,000 aircraft, missiles and electronics workers, have buried the jurisdictional dispute hatchet and have come up with a joint bargaining program for 1960.

The program, developed at a joint conference in Kansas City early this month, is "designed to help workers hang onto their shirts during the industry's changeover from production of manned aircraft to rockets and missiles." Seven major points are involved:

- **Wages:** Asked-for increases will be based on the idea that workers "are entitled to share in the annual improvement brought about by in-increased productivity," that skilled workers deserve more money, that similar jobs in aircraft and missile plants should get similar pay, and that wages must reflect cost-of-living increases.
- **Severance pay:** Laid-off employees with one year or more service should get a half day's pay for each month of service plus unused vacation or sick leave allowance.
- **Relocation pay:** Employee who is uprooted in line of company duty should be entitled to pay for travel time, reimbursed for expense of maintaining two homes, or for moving his home.
- **Union security:** Both unions are aiming at across-the-board aircraft industry closed shops.
- **Medical insurance benefits:** Wanted for workers is adequate normal hospital, surgical and medical coverage, plus major medical, and permission for retirees to continue those benefits.
- **Life insurance:** Should at least equal one year's average income, and should continue in effect for a "reasonable period of time of layoff and leave of absence."
- **Pensions:** Should be 100% employer financed, but jointly administered with the union. Provision to be made for voluntary retirement before age 65. Workers to be entitled to $1000 lump sum benefit on death after retirement. Pensions should be geared to cost of living.

Deer Park on auction block . . .

Fairchild Engine & Airplane Corp's once highly touted but ill-fated Deer Park, L I, plant is closing its doors this week with a public auction sale of $4 million worth of machinery and equipment, plus a private sale of manufacturing rights to its J-44 turbojet engine, and V-32 auxiliary power unit (10hp, V-type gas engine plus a P2 28-volt d-c generator).

Fairchild's Deer Park troubles have been no secret. Air Force cancellation of a small jet engine contract, topped with cancellation of the "Bull Goose" missile last year put thousands out of work at the Long Island facility.

Fairchild management, headquartered at Hagerstown, Md, at 1958's end announced it would turn Deer Park into "the world's most complete job shop," received few takers, but did manage to let out some space to Republic Aviation pending construction of Republic's new $4-million plant at nearby Farmingdale, L I.

The auction starts August 24, lasts five days. First day: expendable tooling, gages, balancing machines, office equipment, cars and trucks. Second day: testing equipment, lathes, milling machines, broaches, profilers, gear-cutting machines and grinders. Third day: more lathes, grinders, shapers, jig borers, radial drills, jig mills, multi-spindle drills, precision tools. Fourth day: presses, shears, comparators, grinders, bending rolls, airfoil millers, welders. Fifth day: odds and ends of office furniture, business machinery, drafting equipment etc.

Axe for the chemical bomber?

News that the government, after spending more than $110 million to develop boron-based fuels and the engines to burn them, is now junking the program raises new doubts over the future of North American Aviation's B-70 chemical bomber and F-108 fighter plane development.

Later models of both planes (scheduled for operational flight in 1963 and 1964) were to have been powered by GE's J-93-5 engine, on which work has now been cancelled.

When and if the order to put the two planes in production is given, volume will be well under presently planned schedules. By using conventional rather than boron-based fuels, range of both planes is cut about 10%, although their Mach 3 speed wouldn't be affected.

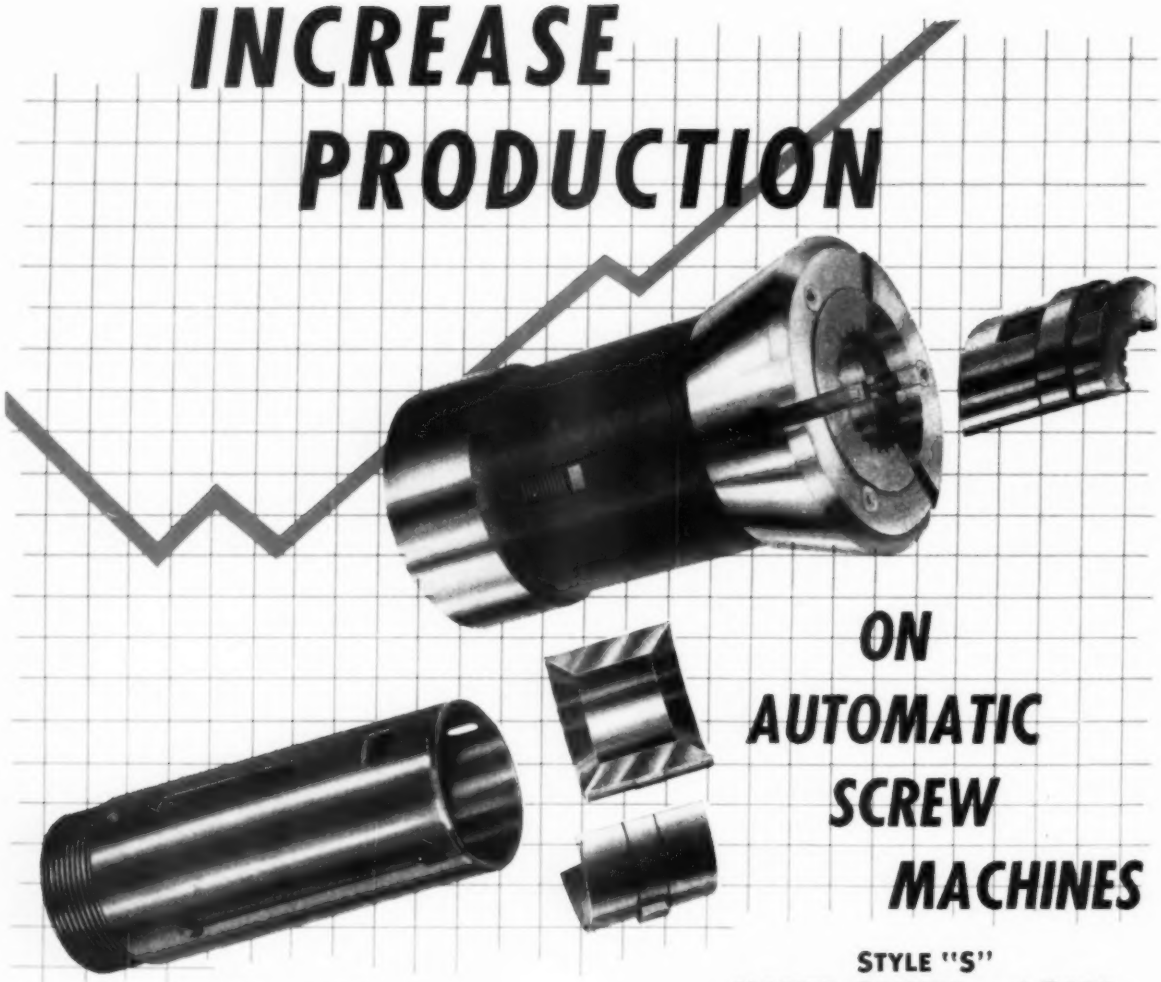
Latest word is that the Air Force plans to go ahead with shopping plans for the lower-priced Boeing B-52 heavy bomber, which can handle air-to-surface missiles.

The procurement schedule calls for 70 more planes to be ordered (some 630 have already been produced or are on order). And 96 more Boeing KC135's will be ordered—about 345 of these jet tankers are already on order or have been delivered.

HARDINGE
ELMIRA, N.Y.

MASTERS and PADS

INCREASE PRODUCTION



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MASTER FEED FINGERS and PADS

Pads Cannot Work Loose
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New Britain — Warner & Swasey

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The Only MASTER COLLET with
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National Acme — New Britain
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MACHINE TOOLS...

G&L to build in Scotland...

Giddings & Lewis Machine Tool Co, Fond du Lac, Wis, and Douglas Fraser & Sons Ltd, Arbroath, Scotland, have formed Giddings & Lewis-Fraser Ltd with Giddings & Lewis having the controlling interest. The new company has taken over the manufacturing facilities of the Engineering Division of Douglas Fraser.

It will make G&L 3-in., 4-in. and 5-in. diameter spindle table type horizontal boring, drilling and milling machines for foreign markets. It will continue to build and market Fraser-designed automatic hydraulic milling and centering machines, automatic production milling machines, automatic multi-spindle drilling machines and a line of units comprising milling, drilling and centering heads used in special-purpose machine tools (under the trade name of Endomatic).

The new company was formed to enable Giddings & Lewis to compete more favorably in the tools (known under the trade name of Endosale of its products in world markets. Douglas Fraser & Sons Ltd has been in the textile industry since 1832 and will continue to operate separately from the new company.

Morton R Swift has been appointed by Giddings & Lewis as vice president—foreign operations.

Orders continue to rise...

Machine tool orders, for both cutting and forming types, are continuing their upward swing.

Business from automobile makers has contributed to this expansion in volume, but has not been dominant. No massive auto tooling programs are now in progress.

July sales were up 50% from the average of recent months for one midwest builder who reports August bookings holding up well. He says that orders this year have exceeded 1958's.

About half his sales are for expansion programs in customers' plants and the other half for cost cutting. His outlook is optimistic.

July bookings for another builder were rated at 12 compared with 5 for last December. But they probably were inflated by an impending price rise.

This builder expects his year's dollar volume to be double 1958's. Orders have come from widely diversified sources, and have been for one to three machines. This is pretty much the rule in the industry.

Twice the volume in July as in June is reported by a builder of general-purpose machines, who predicts that his second-half sales will double those in the first half. Most of his business has been in small machines. Demand for his larger machines is lagging.

Another builder, pessimistic until recently, now is optimistic. He has not experienced the usual summer lull in sales. His order volume promises to grow from here on.

Auto people buy presses...

Sales have been the best in months for a prominent press builder. And the outlook, he says, is "much improved." His July total was boosted considerably by several large export orders.

Automobile companies, both domestic and foreign, have been buying presses lately.

Foreign business has been responsible for much of the production activities recently in plants of several builders. One had on his floor recently machines destined for Japan, India and western Europe.

Good-sized tooling programs are said to be developing in the automobile, turbine, tractor and electrical manufacturing fields.

Rudel to distribute VDF lathes...

The VDF (Vereinigte Drebank-Fabriken) line of general-purpose, production and turret lathes made in West Germany will be distributed throughout the United States by the Rudel Machinery Co Inc, New York, beginning on October 1.

The VDF group consists of three well-known German builders: Gebr Boehringer GmbH at Goppingen, Heidenreich & Harbeck at Hamburg, and H Wohlenberg KG at Hannover. It offers a complete range of lathes in all sizes. The three companies together produce more machine tools than any other German group.

VDF Lathes will be a division of the Rudel Machinery Co Inc, with Ralph Edwards as sales manager. Service and parts facilities will be maintained by Rudel for U S customers.

Orders placed for India...

America East India Corp, 25 Broadway, New York, is reported to have bought this year $3 to $5 million of U S machine tools for delivery to various plants in India. This company is the buying agent for the Birla group of about 70 manufacturing firms in India. It is owned by the East Indian Produce Company, Ltd, 42 Curzon Street, London.

Firms in the Birla group which have placed ordere here have sent over employees to be trained as service men by U S builders.

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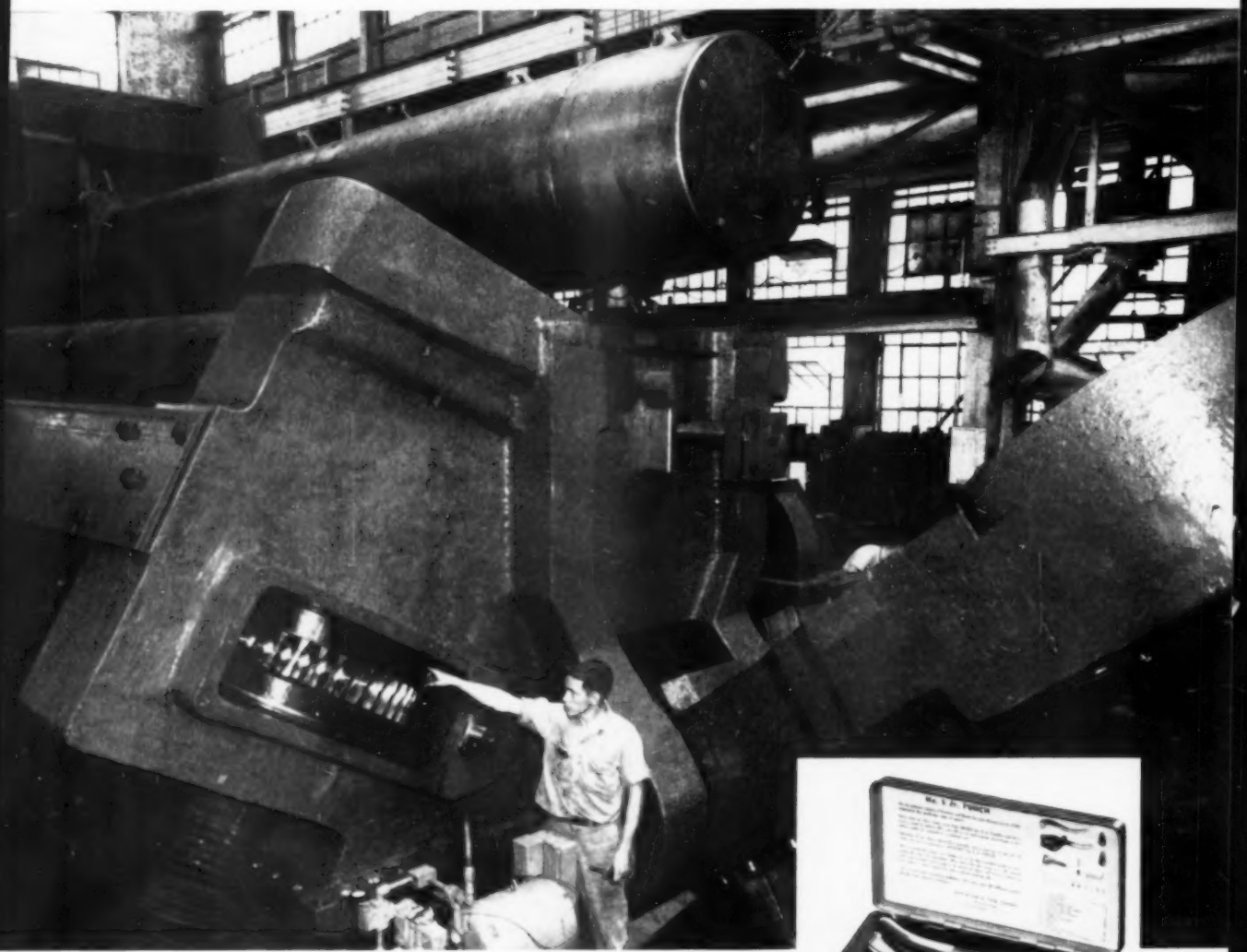
So next time you are considering the purchase of new equipment, get in touch with the machinery specialist at your nearby Ryerson plant.

The Ryerson line includes machinery for: bending, braking, drilling, forming, hoisting, pressing, punching, rolling, sawing, shearing, threading and welding. Also a special line of material handling equipment.



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CIRCLE 214 READER SERVICE CARD

TRENDS

MATERIALS...

Mechanical ceramics . . .

Alumina ceramics developed by the Electric Auto-Lite Co, Toledo, Ohio, for mechanical applications have outlasted the material replaced by from 3:1 to 100:1. On a company designed grinding machine, used to shape unfired spark-plug insulators, ceramic rods were installed to replace worn HSS drillrod, which was polished before installation.

Every time an insulator is processed, a fired ceramic rod makes a 90° turn forward and back, rubbing against a bronze bushing as it turns.

Service life of the drillrod varied from three weeks to three months. Many of the ceramic rods, reinforced by crs shafts, have been in continuous service more than two years, making some four-million turns. The most wear found so far is 0.001 in. The ceramic sleeve is fastened to the crs shaft with a commercial cement and conventional machine lubrication is used.

For wear resistance, two alumina disks were inserted in a V-block at the points of contact with the part being held. The V-block, a jig to hold spark-plug insulators, has shown no wear, nor has it been replaced, in 18 months of service. **Previously,** grooving of the metal surface necessitated frequent replacement.

Static voltage regulator . . .

Tradenamed "Seri-Actrol," a static voltage regulator has been developed by Westinghouse Electric Corp to control silicon rectifier equipment. First use will be to regulate a 600-kw rectifier for Erie Forge and Steel Co, maintaining 250 volts within 10% at a power factor of about 93%, from no-load to rated load.

Regulating principle consists of increasing the commutating reactance when the voltage rises and decreasing the reactance when the voltage drops.

A tertiary winding feeds a portion of the power to the rectifier through a series transformer and the saturable reactors. The amount of reactance in the circuit is determined by the bias current in the dc winding of the saturable reactor. By comparing the output voltage of the rectifier with a reference voltage, the Magamp regulator provides the appropriate amount of reactor bias current to regulate the dc voltage.

Plastic concrete . . .

The Prestressed Concrete Parts Div of the Moscow Metrostroi (subway) claims successful manufacture of experimental plastic-concrete slabs.

Main application of the new material is facing in tunnels of the Moscow subway system. Plastic concrete contains neither water nor cement. **Furfural is used for the binder,** with ordinary sand and gravel as filler material. Reports say that the new material is waterproof, fire-resistant and highly durable.

Aluminum scrap supply up . . .

Foundries and other aluminum users will recover more than 900 million lbs of scrap aluminum in the US during 1959, almost double the 1950 supply. Along with this prediction, the Aluminum Smelters Research Institute, Chicago, said that the annual salvage rate by 1965 would be 1.5 billion lbs, as more and more post-WWII manufactured products with high aluminum content reach the scrap market. Estimate for this year includes approximately 700 million lbs of "new" or generated scrap and 200 million lbs of obsolescent scrap.

Hard surfacing aluminum . . .

New aluminum welding alloys applied to commercial aluminum castings and forgings, as precision-welded zones of super-hardness, offer Brinell hardness up to 250 at room temperature. This material is said by its developers, Alcoa Research Labs, to be as hard as heat-resistant high-alloy steel. Comparable commercial aluminum pistons generally exhibit a Bhn of 110.

When applied to selected areas of aluminum products, the new welding alloys retain this hardness at very high temperatures. Aluminum parts having zones of this hard metal may find use in many automotive applications where localized hardness, wear and heat-resistance are desired. Typical major prospects include piston-ring grooves, brake drums, valve seats and belt sheaves.

Cold-heading steel . . .

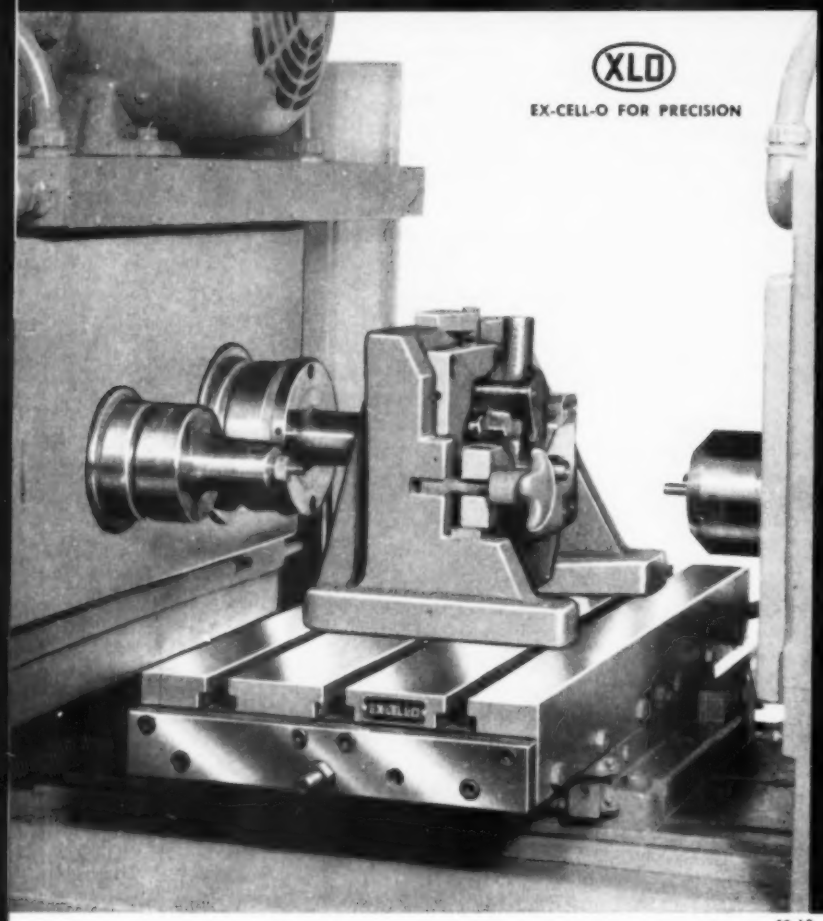
Designed for cold-heading applications (long-run, high-production output of fasteners etc), a carbon tool steel now being turned out by Latroble.

Steel is claimed to have achieved production gains of from 2-to-1 to 4-to-1 over carbon cold-heading steels used by one fastener firm.

And in briquetting of cast iron chips, the alloy is said to have outworn normal low alloy carburizing steel grades by 40 to 1.

Alloy is also applicable to cold striking dies, cold coining dies, tube drawing dies and mandrels, swaging dies, hammers, rolls and punches.

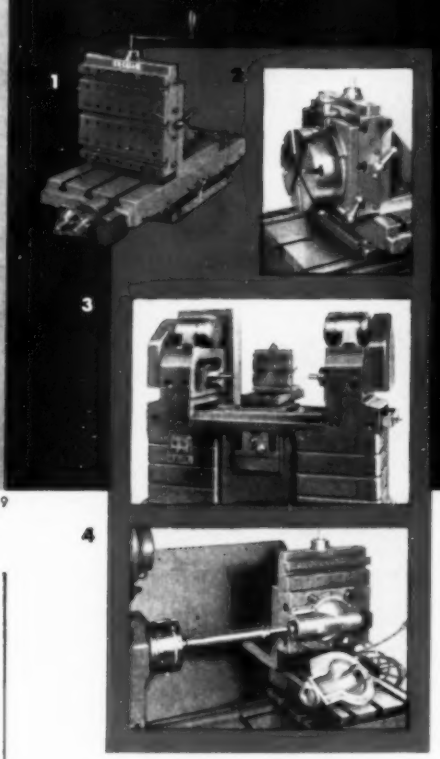
Add production flexibility the low-cost way, with EX-CELL-O UNIVERSAL FIXTURES



- Faster parts changeover
- Easier work setups
- More work from your present machines

LEFT
Hydraulically-operated cross slide of Universal Fixture supports angle plate fixture for production boring and facing.

BELOW
1 Manually-operated unit equipped with vertical slide. 2 Rotary Index Table mounts on Universal Fixture, has vernier scale for precise angular settings. 3 Installed on Style 17-A Precision Boring Machine, Hydraulic Universal Fixture increases versatility at low cost. 4 Adaptable to many operations, this Universal Fixture permits fast setup for line-boring and finish-facing work.



59-19

There's no end to the variety of boring, turning and facing jobs your Ex-Cell-O Precision Boring Machines can do when fitted with Universal Fixtures!

Designed for both short-run work and volume production, Ex-Cell-O Universal Fixtures come to you ready to mount on the machine table. Base, bracket and slides are normalized nickel-iron castings, with precision-machined T-slots and tapped holes for quick setup and accurate alignment of spindle to fixture. Work, fixtures or tools can be mounted at any position on the vertical or horizontal slide; inbuilt micrometer adjustment assures accurate setups.

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CIRCLE 215 READER SERVICE CARD

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WHAT'S AHEAD... in Metalworking

TRENDS

Steel shortages beginning to take effect...

As August draws to a close, strike-caused steel shortages are beginning to make themselves felt —not much, but enough to halt the fast upward climb in metalworking production.

It's not the big companies or the small farsighted companies that are affected by shortages, rather it's those firms that either lacked capital to lay by a sufficient supply of steel before the strike started, or that for one reason or another refused to build up a strike stockpile.

The shortages are affecting some areas more than others. Cleveland metalworking firms, for instance, report they could hold out (as of mid-August) for another month of strike.

But the Chicago area faces a crisis much sooner than that, reason being that metalworking in that area picked up faster than in most of the nation and the city was in too short a steel supply to build up an adequate strike backlog.

Auto industry model changeover shutdowns, plus two-week company vacations are having their effect on the overall metalworking production picture, too. But this is annual.

Automotive parts producers, who are currently drifting through the summer doldrums, are nevertheless anticipating an excellent year, both in new car and replacement parts.

Gray iron and steel foundries now report that sales and orders, which have been increasing steadily since last year, have declined slightly. **Steel foundry production** is currently running at about 62% of maximum demand, and gray iron foundries report an "encouraging" operating rate.

Both industries believe the slight setback is of very short duration, that operating levels will pick up markedly by summer's end.

Stamping shops report good sales despite the slowing effects of summer vacations. Particularly strong is demand from makers of textile equipment, farm machinery and automobiles, while electronic and missile control equipment continues to be a top market for stampings. Model changeovers for the industry have been completed and production is expected to stay high through the year.

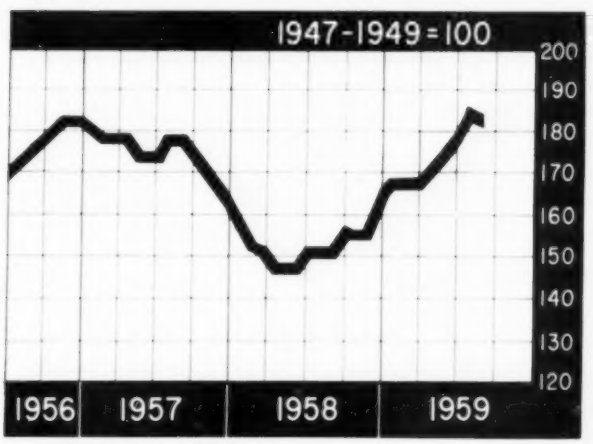
Makers of screw machine products report that customers' steel inventories are sufficient to carry them through a three months' steel strike. By customers, the screw machine products people mean the well-stocked auto and appliance industries. Industry spokesmen look for a steady pickup in orders throughout the year.

Job shop business up 5% ...

Metalworking job shops generally are finding business good—about 5% above last-year levels —expect a big pickup in first quarter 1960. Die-casting firms, however, report that business is now "very slow," following a good spring. Prime reason: customers stocked up heavily in anticipation of the steel strike.

Heat treating job shops seem to be in the same boat as the die casters, because many customers had a good share of their heat treating work done before the strike came, and consequently have little business to offer now.

In both the die casting and heat treating industries, the bigger firms are in better shape than the little ones, can fall back on backlogs.



AMERICAN MACHINIST INDEX OF METALWORKING PRODUCTION

BASED ON MANHOURS WORKED IN THE FIVE COMPONENTS

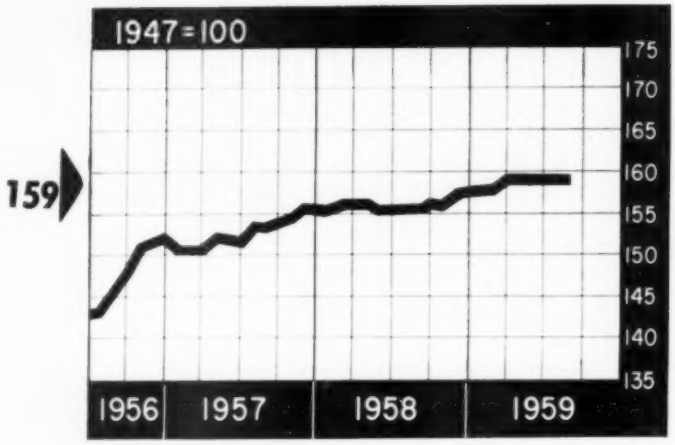
	AUG Estimated	JULY Preliminary	JUNE Revised	JULY Year Ago
Total Index	**183**	**185**	**183**	**178**
Machinery	155	154	126	
Electrical Machinery	220	218	181	
Autos	141	139	84	
Other Transportation	351	351	333	
Other Metalworking	159	158	135	

TRENDS

WHAT'S AHEAD... in Business

AMERICAN MACHINIST INDEX OF METALWORKING PRICES

	JULY Estimated	JUNE Preliminary	MAY Revised	JUNE Year Ago
Total Index	**159.0**	**158.8**	**158.7**	**155.8**
Metalworking Machinery ...	185.6	185.3	181.2	
Other Machinery exc. Electrical	169.8	169.7	166	
Electrical Machinery ...	160.2	160.0	158.9	
Fabricated Metal Products	148.8	148.8	133.1	



Peak output presses capacity...

There is growing evidence that manufacturers are beginning to feel a new pinch on producing capacity, and will consequently be adding new plant and equipment to keep up with the swelling demand for output. Several large corporations have already announced plans to build new manufacturing facilities, and others are likely to follow suit.

Reflecting manufacturers' plans to expand their producing facilities, new orders for capital goods have been running at high levels in recent months. The McGraw-Hill Index of New Orders for Machinery rose to new record highs in each of the first two quarters of this year.

The new emphasis on expanding capacity indicates some change in business thinking in recent months. In response to the annual McGraw-Hill Survey of Business Plans for New Plants and Equipment last spring, businessmen said they would be modernizing existing plant rather than expanding capacity this year.

Those early plans were based on the recession experience last year, when output was cut sharply and manufacturing industries were operating at about 70% of capacity rather than the preferred rate of 90%. Manufacturers thus were more concerned with cutting costs than with being able to expand output as they went into 1959.

Record levels of industrial production set throughout the first half of this year, however, have changed that picture. By June of this year, manufacturing production had risen about 25% above the recession level of last year, and the estimated average operating rate of manufacturing industries climbed above 85%. A number of companies thus are at or beyond their preferred operating rate and are feeling a pressing need for added capacity.

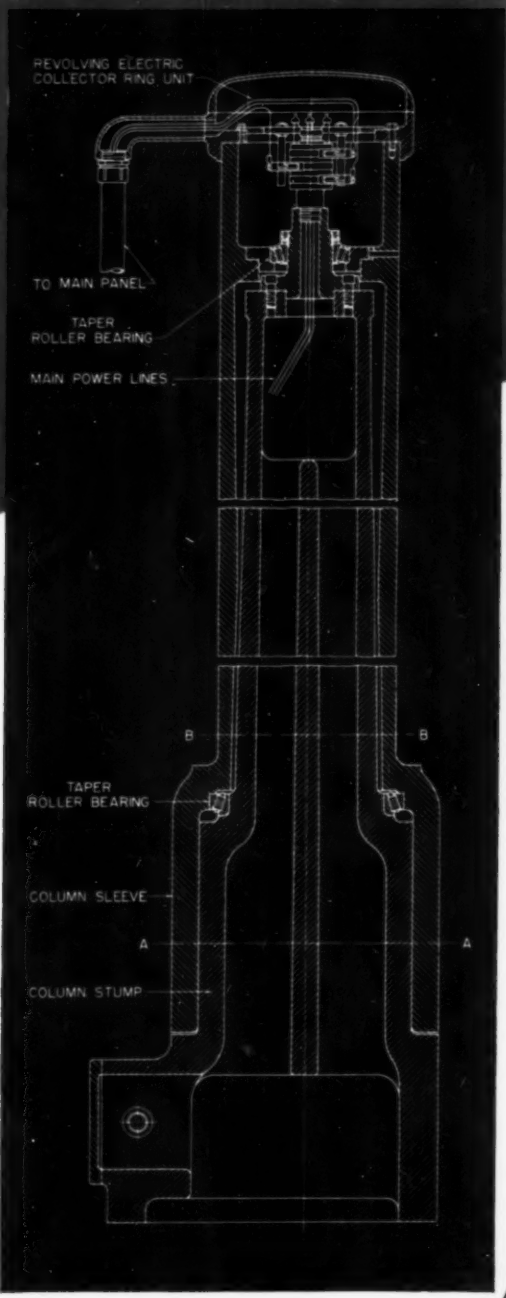
With corporate profits and personal incomes both running at record highs the pressure on capacity is likely to continue for some time.

WEEKLY BUSINESS INDICATORS	Latest Week	Preceding Week	Year Ago
Business Week Index of Activity (1947-49=100)*	152.4	153.5	137.7
Steel ingot production (thousand tons)	332	318	1,632
Electric power output (million Kilowatt hours)	13,675	13,775	12,707
Production of automobiles and trucks	117,516	146,076	81,066
Engineering construction awards (Eng. News-Record, millions)	$412.4	$411.7	$336.9

MONTHLY BUSINESS INDICATORS	Latest Month	Preceding Month	Year Ago
Refrigerators sales (thousands of units)	361	308	316
Vacuum cleaners sales (thousands of units)	274	257	253
Washers sales (thousands of units)	342	207	289
Household electric ranges sales (thousands of units)	77	72	64
Radio production (thousands of units)	1,430	1,039	774
Television production (thousands of units)	571	432	377
Gear sales index (1947-49=100)	274.2	241.0	173.8
Foundry equipment new orders index (shipments, 1947-49=100)	N.A.	157.0	87.7

* Seasonally adjusted
N. A. Not Available

Rigidity Increased 50%



New thrust resistant, "TIMKEN" mounted column and sleeve assembly.

The new "TIMKEN" mounting of the column and sleeve on the new model 32-speed Hole Wizard Radial has hit the "jack-pot" for rigidity. It's the stiffest, most resistant column unit we've ever known.

Under drilling tests up to 30 horse power deflection has been cut in half over former models. It's truly a marvel of rigidity.

Large Timken bearings at top and bottom when preloaded bind the column and sleeve into the equivalent of a solid unit for resisting functional stresses and cuts arm deflection to an absolute minimum. This definitely results in greater accuracy and longer cutting tool life. To further increase resistance to stresses the column sleeve departs from conventional design by employing a tapered inner wall providing an unusually heavy section where the greatest functional stresses are concentrated.

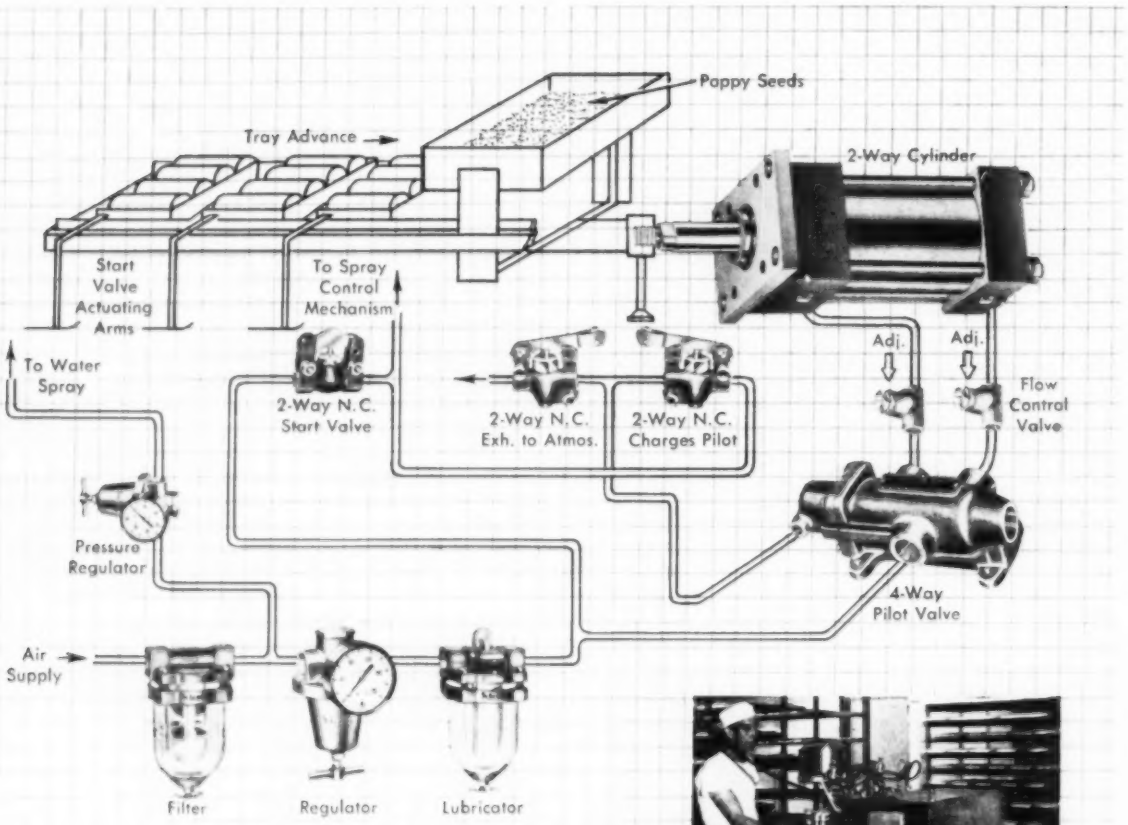
A new "NON-CREEP" clamping mechanism in combination with a solid column sleeve cuff adds greatly to the rigidity of this new "AMERICAN" Radial.

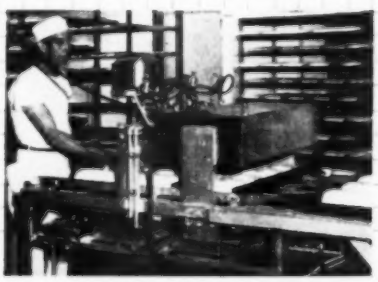
Write for Bulletin No. 328 for the complete story of More and Better Work at Lower Cost.

THE AMERICAN TOOL WORKS CO. Cincinnati 2, Ohio, U. S. A.

LATHES AND RADIAL DRILLS

PLANT MAKES STANDARD SCHRADER AIR PRODUCTS DO 65% OF THE WORK AUTOMATICALLY





Here's a typical example of how companies can automate with air. The hookup of Schrader Air Products in the large picture was used to perform repetitive operations by General Baking Company, Detroit, Michigan. A tray of loaves moving on a belt trips a Schrader 2-way valve which actuates the water spray mechanism—and starts the 4-way valve-operated reciprocating system. The 4-way valve operates the cylinder which sifts poppy seeds onto each loaf in turn. This was formerly repetitive hand work. Schrader representatives helped plan this effective air system, as they have helped plan innumerable others.

Get full productive power from your manpower and machines, like this company. Simply take advantage of the *air* you already have! Hook up Schrader Air Products to fit your needs and get these benefits:

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QUALITY AIR CONTROL PRODUCTS

American Machinist
MAGAZINE OF METALWORKING PRODUCTION • ESTABLISHED 1877

What the Revolution Means

Steep upward production curves tell the story of what has been happening to the economy of Western Europe. As estimates are projected into the 1960s, the curves continue to climb. The rate of annual growth outruns ours. Europeans have never had it so good.

Nowhere else is the revolution in the purchasing power of the peoples of Western Europe so dramatically illustrated as in the automobile industry. A detailed special report on that industry's mushrooming growth starts on page 93 of this issue.

The facts are eye-openers . . .

Car and truck production—in Germany, Britain, France, Italy and Sweden—has doubled the past five years. By the early 1960s it is expected to be more than six million units a year. And the end of the climb is not in sight.

Manufacturing methods over there are just as advanced as here. If you were to find yourself in the center of the mammoth Fiat works in Turin, Italy, you would think that you were in Detroit. Production processes are just as impressive and just as automated. The same can be said for Volkswagen or Renault or Austin or Opel or Ford of England.

The spectacular upsurge . . .

in European automobile demand is only partly the result of greatly increased domestic buying. It also is attributable to major success in world markets where the Germans are first, the British second, the French third, and we a poor fourth.

The automobile industry of western Europe, just as our own, has a far-reaching influence on the economy of each nation, and also upon the international economy. It provides large-scale, profitable business for hundreds of manufacturers, from production equipment and steel making to parts and components suppliers, not to mention the service industries.

But the automobile industry is not the sole example of the revolution in the consumer good industries now sweeping Western Europe. People have more money to spend because they are getting constantly higher wages and are more fully employed. They are aided by the spread of installment buying which until recently was frowned upon. The result is a burgeoning demand for refrigerators, TV sets and a lot of products that make living easier and more enjoyable. Factories making a wide variety of consumer goods are reaping the benefits from this boom.

This new experience . . .

in Western Europe is a reaffirmation of the economic philosophy on which the material wealth and economic growth of our country are based. More people are employed as nations become more industrialized. As industry mechanizes, the individual workers is able to produce more goods per hour and his wage rate rises.

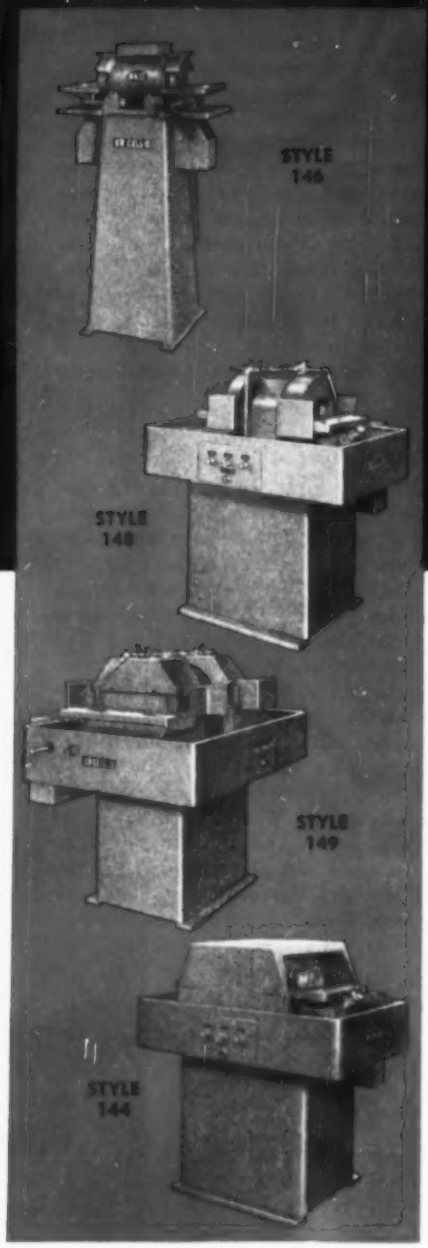
As his income goes up, he is able to buy more of the things that he and his family want. Before long, goods that were considered luxuries become necessities. All of this contributes to an expansion of business in general, including a swelling of trade with other nations.

What's happening in Western Europe, best dramatized in its automobile industry, is all to the good. It is good for each nation, for the economy of the entire European sector, and for the economy of the world.

Burnham Finney EDITOR

A FULL LINE OF EX-CELL-O PRECISION TOOL GRINDERS

STYLE 264



Ex-Cell-O Precision Tool Grinder line includes: Style 264 (above), an electrolytic reciprocating model for lower-cost sharpening of carbide tools, and the similar Style 142 (not shown) for conventional grinding; the Style 146 finish grinder, which uses 6" plate-mounted wheels; Style 148, which uses 10" wheels for roughing and finishing larger tools; the Style 149, with 14" grinding wheels and heavy-duty Spindle; and the Style 144 finish grinder with Ex-Cell-O Precision Spindle. Style 264 and 142 provide automatic reciprocation for face grinding, and manual reciprocation for grinding chip breaker grooves.

59-26

For toolroom economy, efficiency and production

Since 1932, Ex-Cell-O Precision Tool Grinders have saved time, increased production and improved toolroom accuracy in sharpening flat and dovetail forming tools; grinding single-point lathe, planer, shaper and boring tools; plunge grinding chip-breaker grooves; and sharpening solid carbide, carbide-tipped, alloy and high-speed steel tools.

For help in selecting the model with the features you need for faster, better tool grinding at lower cost, call your local Ex-Cell-O Representative, or write direct for details on the complete line of Precision Tool Grinders.

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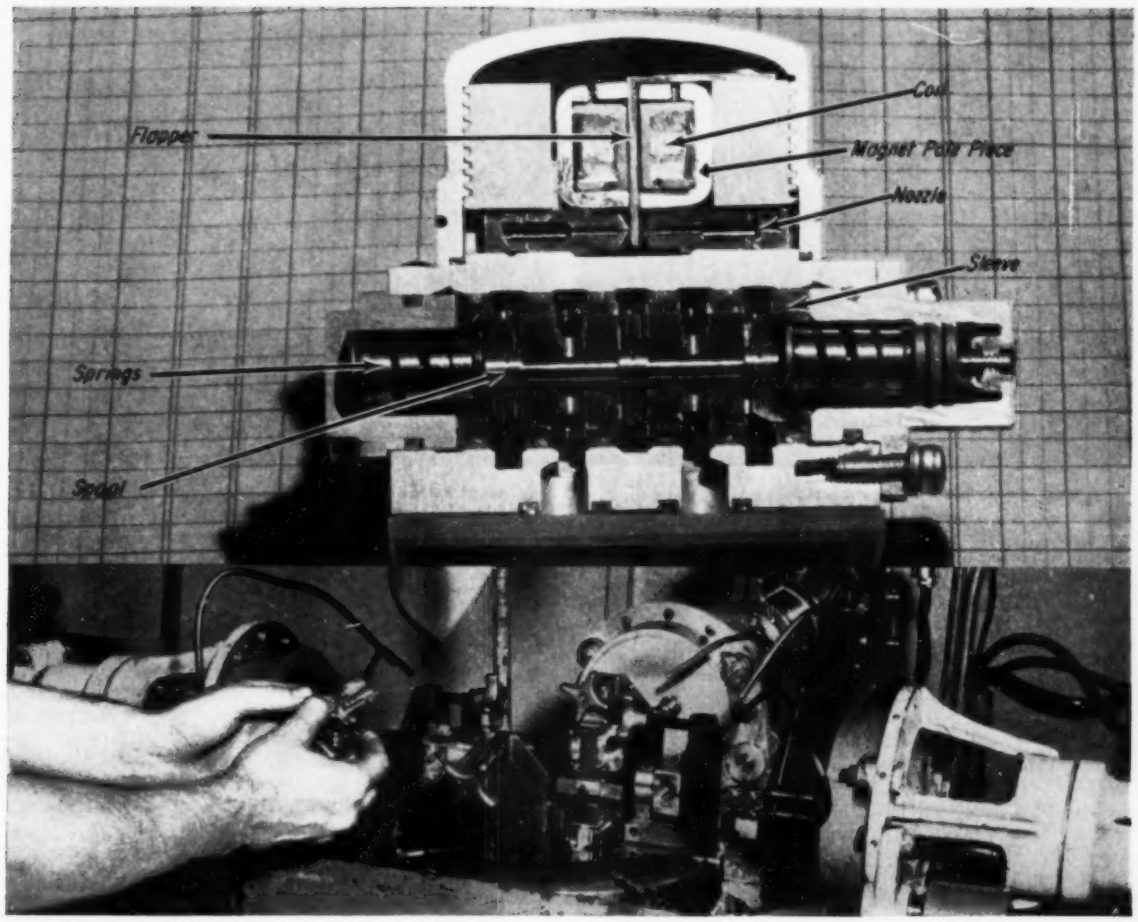
CIRCLE 218 READER SERVICE CARD



Drill-O-Mation is flexible . . .
Machine built by Dalmo-Victor drills servo bodies in several sizes with different hole diameters and depths. Heads can be interchanged at three work stations; fourth station is load and unload. Operations include drilling 13 holes in four sizes

"Special" tolerances at mass-production rates

By George Perazzo, assistant plant superintendent,
Dalmo-Victor div of Textron, Inc, Belmont, Calif

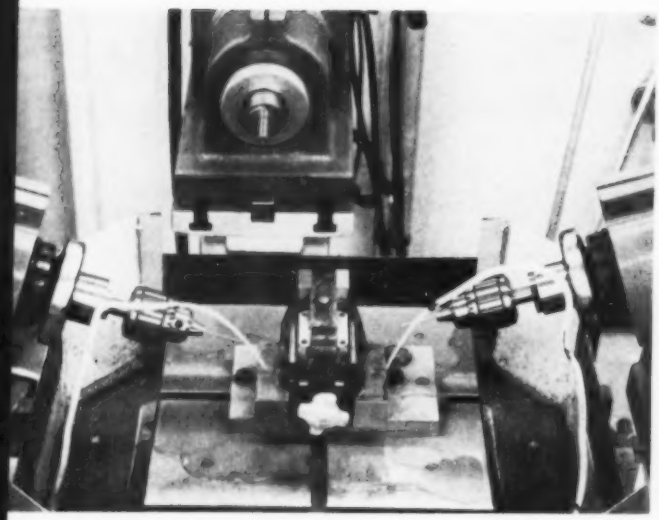
Precision parts can be made interchangeable if they are produced on special precision equipment that guarantees exact tolerances. Dalmo-Victor applies this idea to precision servomechanism components by making mass-production techniques work for small lots—economically. Special shop-built equipment will process many sizes and styles of parts, holding "special" tolerances at no serious sacrifice in economy.

Ordinarily such close-tolerance parts—some to 0.000,025 in.—can only be produced with selective fitting and expensive individual handling. But a number of shop-built drilling, boring, and inspecting machines have been developed to hold these tolerances at high production rates on lot sizes of only 50 to 1000 pieces.

Not that the company can't use standard, commercially available equipment, however—a full complement of general-purpose machines is required for ordinary machining operations. But tolerances are too tight on some parts, and standard machines can't operate efficiently or economically on some operations. On the other hand, production volumes are too low to justify special, single-purpose machine tools.

The special machines include such standard components as Dumore automatic drilling and tapping units, Commander and Zagar multiple-spindle heads and Ettco-Emrick automatic indexing tables. These have kept machine costs much lower than they would have been if the machines had been ordered complete from outside sources. With special fixtures, these machines are sufficiently flexible to handle a great many different parts within the range of their capacities.

Some of the machines on the valve-



Opposed holes are drilled . . .
Angle bars and adjustable bases set up drill heads around fixed table to drill 0.055-in. holes 29/32 in. deep at 18° 45 min. Fixture includes bushings that control hole locations

Eight-spindle "boremalic" . . .
Shop-designed and -built drilling machine has two banks of four spindles each. Valve bodies are milled to produce 0.250-in. radii 0.125 in. wide, and to create angled flats at 50/hr

body production line are typical of those installed to make "low-cost, standardized" parts for precise, highly specialized servomechanisms. A "Drill-O-Matic," for example, has three work stations, each with a Dumore Series 28 Automatic Drill-N-Tap unit coupled with a Commander multiple-spindle head. This head and similar Zagar heads are interchangeable and can be used separately when desired. The table is an Etteo-Emrick automatic electrical four-position unit connected to the heads for automatic cycling. A modified geneva mechanism permits indexing within 0.002 in. at the bearing—but tools are designed to hold this indexing accuracy on hole location, too.

Cycling is either automatic or manual, as desired, with any or all of the heads in operation. Indexing can be continuously automatic after the heads complete drilling and retract. With manual cycling, the heads start drilling after the cycle button is pressed and, while indexing occurs after the heads retract, the cycle ends there and must be started again manually.

A 12-in. sine bar helps set the heads to any angle from zero to 90° in the vertical plane, and the desired tilt is controlled by accurately jig-bored links. For deep drilling small holes, the Dumore cycle timer retracts to allow chips to be cleared.

Accuracy is controlled by the fixtures, rather than by the machines. Traveling bushings in the drill fixtures, for example, are indexed around with the work so every part is identical regardless of the accuracy (or any lack of it) in the indexing mechanism.

Operations on the 2024-T4 aluminum valve body include drilling four 0.089-in. dia holes ¼ in. deep; four 0.0785-in. through holes; one 3/16-in. through hole; and four 0.089-in. holes 0.125 in. deep. Other operations include drilling even smaller and deeper holes such as three 0.055-in. holes ranging in depth from ½ to 1⅛ in. Rough and finish boring a 0.378-0.382 hole 0.052 to 0.056 in. deep completes one of the Drill-O-Matic operations on this part. Production rates run nearly 100 parts per hour.

Eight-spindle "special"

Another special Dalmo-Victor machine on this line is an 8-spindle "boremalic" with a built-in indexing table for milling, drilling, boring, and grooving the valve bodies. This machine has four spindles each in two banks of opposed heads. Two spindles on the right bank are equipped with hydraulic cylinders for motion that produces snap-ring grooves. The work may be carried through three cycles: (1) bore, index, bore, and return to start; (2) bore only, with the table stationary; and (3) for milling, the cutters advance, the table feeds, returns, and the cutters retract.

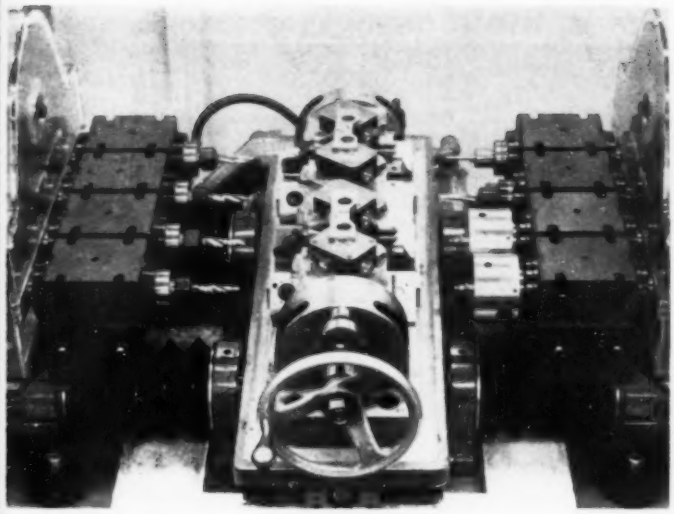
Trunnion fixtures permit loading and unloading from the top while operations are performed at the sides. Where adaptable, hydraulic self-leveling clamps hold the parts in place. These clamps compensate for a few thousandths of an inch difference in the outside dimensions of valve bodies so that costly close tolerances need not be maintained here. Precision alignment of the bores with the tools is maintained by the fixture.

Eight spindles and a 4-station fixture mill five ports and two angular flats in the valve bodies. One part is completed with each cycle to produce nearly 50 hr. This work is followed by drilling and trepanning the bodies in the same machine but with another 4-station fixture. Four spindles produce 50/hr.

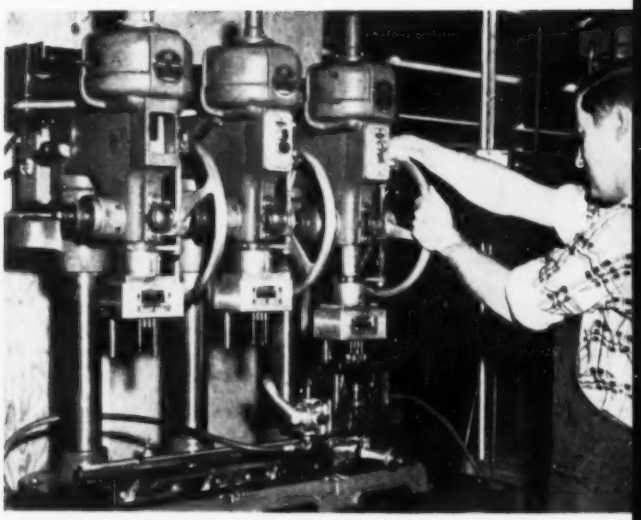
Every valve body has two filter ports each consisting of four diameters and a snap-ring groove. These are produced on the "boremalic" with a trunion indexing fixture. Dalmo-Victor-designed grooving heads, and sub-land step drilling and boring tools. The fixture holds 16 valve bodies and all work is completed on two bodies at the end of each machine cycle. Rough and semi-finish bores are produced by the rear opposing two spindles, and finish bores and ring grooves are produced by the front two opposing spindles. Only one clamping of the part insures concentricity. The parts are loaded and unloaded on top of the fixture while the cycle is in operation. Production is about 100/hr.

Pumps reamed

Another unusual setup is for master reaming, developed by modify-



Progressive indexing fixture . . .
Another "borematic" bores, chamfers, and grooves valve bodies at 16 stations, finishing two parts per index at 100 pc/hr. Bores are to ±0.001 in.; groove is 0.461 in. ±0.002 in. deep, 0.0295 in. ±0.0015 in. wide



Master reaming setup . . .
Multiple-spindle Walker-Turner drills hold bores within ±0.000,-05 in.; centerdistances between holes to ±0.00015 in. Bushings in the fixture guide carbide-tipped reamers

ing a 3-spindle Walker-Turner drill-press. Interchangeable pump body parts are rough, semi-finish, and finish reamed within bore tolerances of ± 0.00015 in. and centerdistances of ±0.0001 in. by using accurately located guide bushings and carbide reamers. Two 0.18725-in. dowel holes are rough, semi-finish, and finish reamed in aluminum pump bodies while similar operations are performed on gear-shaft holes of the same size in phosphor-bronze inserts. Surface finish is 32 mu-in. rms, production is close to 50/hr.

Dowel-pin holes in the steel plate are master reamed in the same setup with similar results. The phosphor bronze pump-body cover cap is also worked at 50/hr to close tolerances and high surface finishes. Two dowel-pin holes in this part are master reamed, as are two gear-shaft holes.

These parts are air clamped in their fixture for reaming after all holes are drilled, tapped, and completely deburred. Location is established from any two drilled holes, and all close-tolerance holes are worked in one setting without moving the part. As a result, each part that comes out of a fixture is drilled identically with others, and is therefore completely interchangeable.

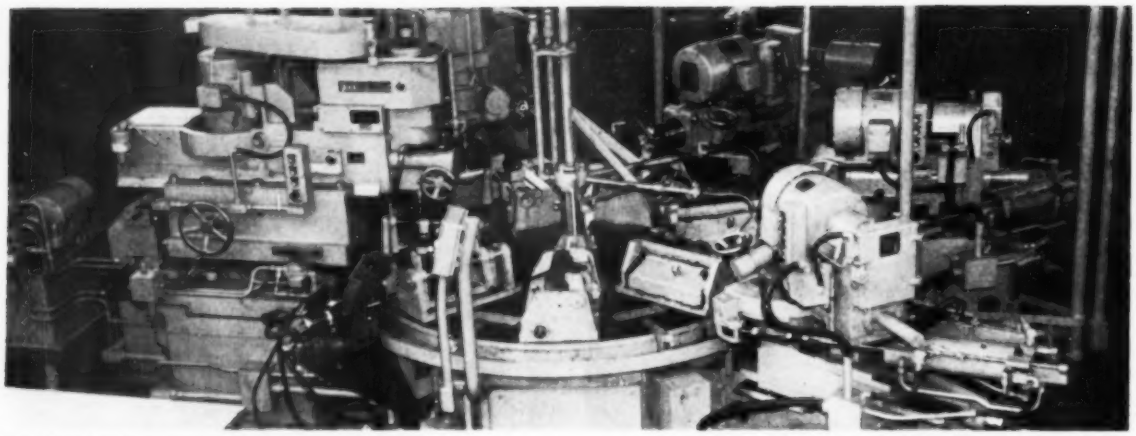
Any of these three pump parts can be switched from one pump to another, and the symmetrical plates can be assembled with either side up. No selective fitting is required.

Servo sleeves and spools, however, are where the real tolerances enter the picture. These components are made of 52100 steel hardenend to Rc 60-64. A Sheffield cylindrical form grinder plunge grinds grooves and recesses on the sleeve. The spool is also plunge ground from the solid 3/16 in. OD to ⅛ in. in diameter with the linear shoulder dimension being held to +0,–0.00005 in.

Special checking fixture . . .
Shoulder dimensions on servo spools are checked within 0.000,05 in. after being plunge ground in a Sheffield cylindrical form grinder. Spool diameters are later lapped. Clean room has filtered air; intercom; personnel wear white Nylon caps and coats and cannot use face powder

A special checking fixture was designed and built by Dalmo-Victor to inspect the spool after grinding. Fine carbide gage blocks establish the basic linear dimensions for the spool. Air fingers actuating 10,000-to-1 Sheffield air columns are mounted on the slides, and these pick up the gage-block locations. With a very short movement, the fingers transfer to the spool, and the column is read for actual dimensions.

The sleeve assembly is of segmented construction. The segments are lapped on a Norton machine to correlate with the linear dimensions of the spool within ±0.000010 in. Checking is done on a 10,000-to-1 comparator, using carbide set blocks.



Turbine-bucket automation . . .
carries blanks of several sizes around indexing table past six milling heads. Fixtures are adjustable for any workpiece size and shape

Re-engineering mechanizes turbine-bucket production

Turbine buckets in job lots of 150-300 pc are being machined to within 0.0002 in. because new mechanized equipment made part redesign and methods changes necessary, which in turn made mechanization possible

By L C Kehn, Jr., small steam turbine dept, General Electric Co, Fitchburg, Mass

Standard dovetail angles and controllable tolerances make it possible to machine many sizes of job-lot turbine buckets in a single mechanized setup, which makes the mechanized equipment economical for these small lots. How bucket production got to this stage, however, was a process of practical steps that involved many changes of ideas on design, dimension, and fabrication.

Buckets for small steam turbines have been made for more than 20 years by the same method; machining in conventional fixtures, then hand-fitting the buckets to their wheels. When we first considered automation we tried to pick equipment that would run the parts through the usual sequence of operations, but this turned out to be our first mistake. We had to reverse our usual machining practice and base methods on machine functions to allow progressive fabricating.

We also realized at the same time that many of the variations and tolerances that complicate turbine production are perhaps unnecessary. We had to change bucket design and specifications to suit mechanized fabricating, which sounds impossible, but worked.

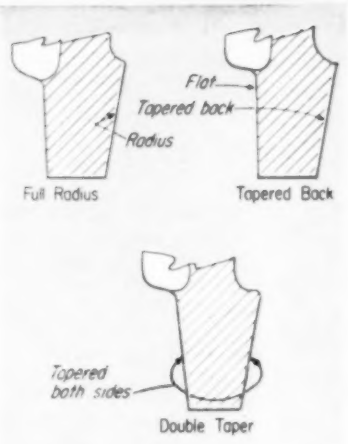
First, all tied-in edge designs had to be changed to use the same equal angles on all buckets, regardless of size. This allowed standard cutters, gages, fixtures, and setups.

Then more equitable tolerances on dovetails between buckets and wheels had to be worked out, and intersecting curved and spherical dimensions had to be recalculated. This provided the key missing dovetail specifications that finally made the mechanization program possible.

The new bucket design included five dovetail variations, milled straight or with radii from 0 to 26 in., and with tenon sizes from 3/16 to $\frac{5}{8}$ in. All machining operations on all sizes are the same except for one final cut on each.

Blades vary from $\frac{3}{4}$ to $2\frac{1}{4}$ in. wide and are milled through or stepped at the base where the dovetail begins. Lengths vary from $\frac{1}{2}$ to 7 in., and thicknesses from 3/16 to $\frac{1}{2}$ in. Blade tips average 0.02 in. thick. Blade forms may be full radii, or may be combinations of radii and straight lines. The center of the blade is not milled in the mechanized unit, but general blade shape is used to locate the part in the fixture.

Tolerances for all dimensions are standardized, and though they are tight, they are at least in the repeatable category. Finishes to 80 mu in. are milled, then the buckets are refined to 32 mu in. mechanically, not with hand polishing as before.



Bucket bases are machined . . .
to a number of shapes—flat, radii, or tapered

The mechanized unit is a circular transfer table with milling heads at index stations. Each work fixture that carries the bucket around the table is fixed; all curved and straight-line motions necessary are produced in the milling heads.

The machine has six working heads and one extra station for the future. A 2x8-in. bucket can be indexed and machined to complete a three-step curved pine-tree dovetail, sides and base, length, tenon, and base fits and steps in two minutes. In addition, anything from 200 to 500 parts can be produced with dimensions within 0.0002 in. of each other. The increase in quality alone, which eliminates polishing, hand fitting, extensive checking, and close inspection, is enough to justify the equipment.

50 workers keep plant going under state of siege as ...

Cross Co battles it out with UAW

At press time, some 50 production workers were eating, sleeping and working in the Fraser, Mich, plant of the Cross Co in a virtual state of siege. The besiegers: Local 155 of the United Auto Workers plus assorted friends ("Union goons from all over," according to company officials: "Sympathetic auto workers passing by on their way to work," according to union officials).

Months of smoldering resentment between Cross management and the UAW, during which charges and countercharges of unfair labor practices and rigged elections were hurled back and forth, flared into violence the morning of August 4, when squads of pickets blocked the plant's entrance, turning away workers and executives alike.

Other flareups have occurred since —threats, fistfights, rocks thrown at cars—but no one has been seriously hurt.

Picket with rock in hand (circle) watches supervisors' cars leave Cross Co's plant at Fraser, Mich. No violent incidents took place at this time, but later windshields were broken, and one picket was knocked down by a car driven by a would-be job applicant.

Dissension in the ranks

Cross's labor troubles date back to last October, when its first two-year contract with UAW expired. Then, dissatisfied employees called for an election to oust the UAW as bargaining agent for Cross workers. UAW won the election by 16 votes as 265 workers cast their ballots, but a few days later 27 employees signed affidavits protesting union statements about the company. In essence, the affidavits read "If we had known how the union was going to behave we would have voted against it."

Because just nine votes would have swung the election to Cross, the company appealed to the local National Labor Relations Board for another election, was turned down. National NLRB headquarters in Washington upheld the decision.

Asks writ of mandamus

Cross officials in an unprecedented move then asked the United States Circuit Court in Cincinnati for a writ of mandamus (an order forcing NLRB to call a new election). At press time the court's decision on the writ was still pending.

Meanwhile the dissenting Cross workers gathered affidavits from others who no longer wanted UAW as their bargaining representative. These were shown to NLRB, which ruled that no new election could be held until June of 1960.

An attorney representing the dissenting employees then asked Cross management to refrain from bargaining with Local 155 on grounds (Taft-Hartley Act) that a union that no longer represents a majority of employees cannot bargain.

Three Alternatives

Local 155 asked Cross to bargain, was prompty refused, was offered three alternatives: (1) hold a new election, (2) wait for word on the writ of mandamus, or (3) charge the company with unfair labor practices and thus again put the case up to NLRB.

Local 155 called for a strike vote, got it in what Cross management has called a rigged election (ballots counted behind closed doors, with no witnesses).

That was back in June. No strike came, despite the vote.

Then on August 4, dozens of pickets gathered without warning as the plant opened, barred all workers from entering by threatening violence.

50 return to work

The company got an injunction limiting the number of pickets to 10, and the next day office workers, engineers and executives were allowed through the lines. Then, in accordance with law, Cross published an open letter offering work to any employee who wanted it. Some 50 production workers responded, got through the picket lines somehow to hole up in the plant.

The company was ready for them with cots, a TV room, and a commissary equipped with enough food to last for weeks. Then Cross invited reporters in, and as Executive Vice President Ralph Cross puts it, "Our workers gave them a real earful." Sample: "I made about $10,000 a year with overtime before the union came in. Last year with the union I made $4200 and working conditions are worse."

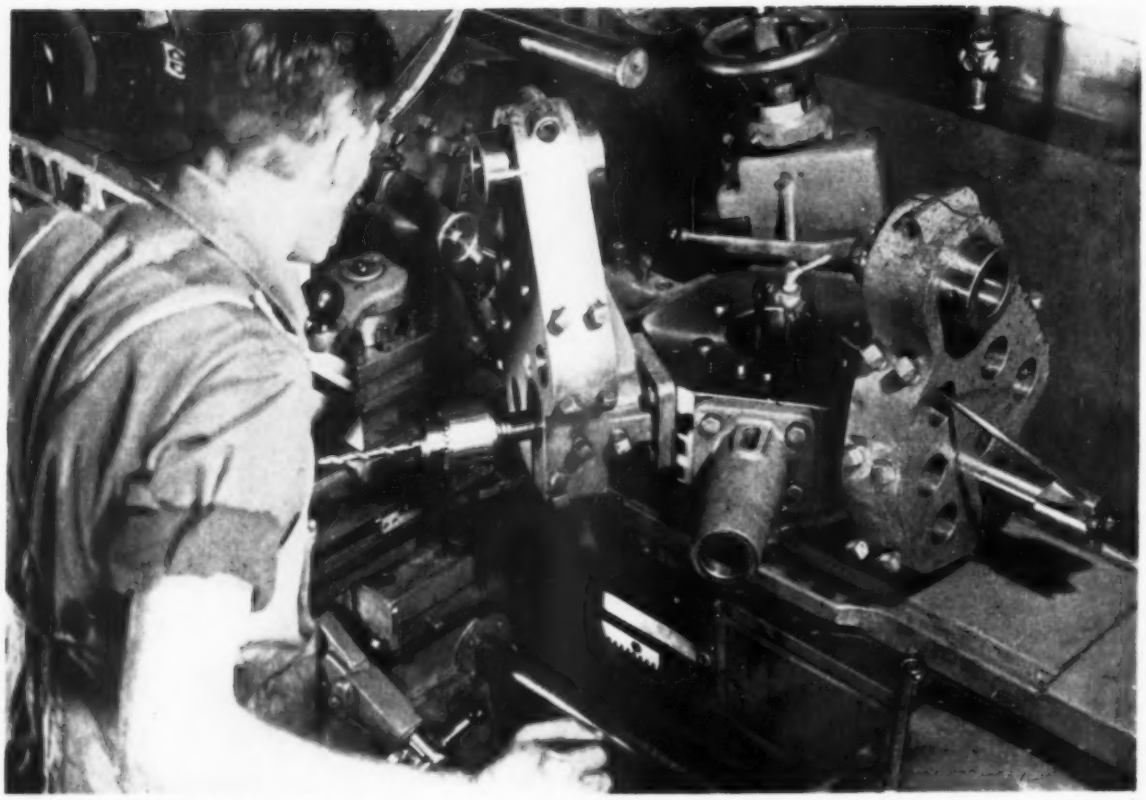
Awaiting new decision

At press time, NLRB's decision on whether Cross was guilty of unfair labor practices had not been handed down. Meanwhile the plant continued in a state of siege, operating at about 35% of its pre-strike rate. Pickets, backed up by sympathizers from Ford Local 600, were still around, but the violent acts on the first few days had degenerated into occasional name-calling and fist-shaking.

Defiant note

And inside the beleaguered plant, Executive VP Ralph Cross sounded a note of defiance.

"How long can we hold out? The 50 workers in here will stay until next winter if they have to . . . just as long as the food holds out. They're fighting for their jobs. I just wish that my morale was as good as theirs."



Machining a cast-aluminum brake arm . . .
. . . on a new Gisholt No. 5 purchased under Barber-Colman's Equipment Justification Program takes just 5.7 min. floor-to-floor machining time compared with 14.1 min. on a similar, older machine. It was estimated in advance with EJP that the new machine would save the company $3265 in its first year of its operation

EJP replacement analysis lets you...

KNOW how fast your new machine will pay off!

One of the toughest questions plaguing metalworking management today is "Just how much will I gain by replacing an old machine with a new one?" Barber-Colman Co, Rockford, Ill, thinks it has found a method that provides the answer *before* the machine is bought.

The system, EJP (for "Equipment Justification Program," a modified version of the MAPI formula) has taken the guesswork out of new machine buying at Barber-Colman for 10 years. It works this way:

Before a machine or other piece of equipment is purchased, an equipment replacement analysis is prepared to show the "adverse" cost of operating the old machine as against the cost of a replacement. (See worksheet on opposite page).

The two sets of figures are projected over the year ahead, clearly indicating the loss or gain from replacement during that period.

Along with this, a written supplement is prepared, explaining the proposal in detail and providing ample background information on the need for new equipment. After a machine has actually been purchased, its performance is checked periodically to determine whether it has lived up to expectations, and the results of this audit are used as a guide to future purchases of similar equipment.

For instance, Barber-Colman bought a new Gisholt Masterline No. 5 ram-type turret lathe in 1957, after making a careful comparison of the costs involved in using a similar, existing lathe.

The analysis indicated that for the coming year (1958), the capital cost and operating expense for the older lathe would amount to $7348 while that for the new Gisholt No. 5 would be only $4083—the difference between the two totals ($3265) being the anticipated gain from replacement during the next year's operation. This amount was in addition to the return on invested capital. On this basis, the new equipment purchase was recommended.

Included with the analysis was a

BARBER-COLMAN COMPANY
STANDARD REPLACEMENT ANALYSIS

Requested by GMM Date 10/56 Proposal number 1086

A. CHALLENGER #5 GISHOLT TURRET LATHE Dept. ____ New X Used — Age —
Estimate — Quotation X Number 78314 Date 2/6/57

1. Machine or equipment #5 GISHOLT TURRET LATHE, AIR CHUCK AND TOOLING

2. Supplier & delivery GISHOLT MACHINE CO. DELIVERY— 4 TO 6 WEEKS $ 18,798.00

Plus - shipping charges	$ 200.00
Inspection and installation	$ 250.00
Other	$ 570.00
TOTAL CAPITAL COST	$ 19,818.00

3. Estimated service life of challenger (years) 15
4. Estimated salvage value at end of service life . . . . . $ 2000.00
5. Salvage ratio R = item 4 divided by item 2 10
6. Lowest annual average of capital cost and operating inferiority of challenger (use chart or table) . . . . . $ 4083.00

B. DEFENDER — TURRET LATHE BC number 1999 Dept 1102 Age 20

1. Operating inferiorities	DEFENDER	CHALLENGER
a. Direct labor	$ 1417.00	$ —
b. Supervisory and administrative		
c. Special tools		
d. Quality (reduction in cost)		
e. Quality (improvement in saleability)	1850.00	
f. Maintenance costs		
g. Supplies		
h. Power		270.00
i. Floor space		
j. Insurance		20.00
k. Other SCRAP AND REWORK	643.00	
TOTALS	$ 3910.00	$ 290.00
DIFFERENCE		$ 3620.00

2. Salvage value now (a) $ 500.00 Next year $ 300.00 Difference $ 200.00
3. Capital additions $ 8000.00 Service life years 5
Annual cost of above (use chart or table) . . .435 . . . . $ 3480.00
4. Defender's next year capital cost, operating inferiority . . $ 7348.00

C. Next year's gain from replacement (B4 - A6) . . . . . $ 3265.00

Recommendations and remarks Recommend purchase of the Challenger

Approved by _____ Date 11/2/57 Analyst [illegible]

written supplement which gave further reasons for buying the new machine. Briefly, disadvantages of continuing with the old machine were:

- High maintenance costs (2850 for the two previous years).
- Replacement parts were no longer available. Parts would have to be custom-built if needed.
- Machine's transmission, in need of rebuilding, delivered only enough power for light cuts, was not built to take heavy cuts such as those with carbide tooling.
- Scrap or rework required three hours per week per shift at an annual cost of $643 or more.
- It would cost $8000 to put the old lathe in good enough shape to operate for the remaining five years of its expected life.

As opposed to the operating inferiorities of the old lathe, the proposed new Gisholt No. 5 offered these advantages:

- More swing.
- Ample horsepower (25hp) and the rigidity needed to take full advantage of carbide tooling, plus adequate spindle speed range to provide surface speeds for cemented-oxide and ceramic tools, too.
- Such modern, rigid equipment as the new lathe, with its higher spindle speeds and greater horsepower, would permit experimentation with high-velocity machining.
- Machine's greater rigidity and higher horsepower, supplemented by air-operated chucking equipment, would save an estimated 15% in machining time on all jobs. **Annual savings in direct labor cost would amount to about $1417.**
- Machine's speed selector would save additional time.

Just how well purchase of the new machine was justified can be seen in the timestudy table at right. **Machining time and setup time savings on 22 parts averaged 38.8%.**

The new Gisholt Masterline No. 5 ram-type turret lathe (25hp, 1800 rpm motor, 16 spindle speeds from 30 to 1500 rpm) achieved savings in machining and setup time with such built-in equipment as a hydraulic speed selector that allows presetting or instant speed changes; lever control that provides Hi-Lo or Lo-Hi speed change in 8:1 ratio without stopping the machine or hanging gears, hydraulic inching and free speed levers, longitudinal feed dials for both carriages; and a 4-position feed trip for the cross slide.

Tooling setup for a 9-in.-long, 3-lb cast-aluminum brake arm (photo on page 84) involves locating, holding and driving by means of an air-operated, counterbalanced faceplate fixture. Locating, chucking and unloading work takes just 0.8 min.

Brake arm is machined in five steps: (1) drilling, (2) forming multiple face diameters in one pass; (3) boring, (4) reaming, and (5) facing the boss at the end of the part with a single tool mounted in the square turret on cross slide. Actual machining time is 4.9 min., while floor-to-floor time with the new machine is 5.7 min., compared with the old 14.1 min. Thus more than 8 minutes are saved per piece on this typical part, and setup time is reduced, too.

Comparative timestudies on 22 parts

(In minutes — setup time per job, machining time per piece)

	Old machine		New machine		
Part number	Machining time	Setup time	Machining time	Setup time	% Time saved
2-60-3	0.288	2.22	0.277	1.95	2%
2WA7	0.270	3.00	0.220	2.68	19%
2WD 23-2	0.350	—	0.218	1.66	38%
WKG 245-2	0.900	2.40	0.287	1.88	68%
3HS 434	0.350	2.10	0.203	1.88	42%
4HS 1044	0.544	1.88	0.297	1.68	46%
4HS 1200	0.300	1.20	0.187	1.35	38%
4HS 1236	0.330	1.82	0.147	1.48	55%
AHLA 206	0.260	1.90	0.141	1.61	26%
DHLC 213-2	0.473	1.81	0.315	2.07	34%
DHLC 203	0.262	2.14	0.207	1.47	21%
3HM 23-30	0.278	2.13	0.190	1.78	32%
3HM H7-3	0.320	2.40	0.222	2.12	31%
SHC 194-2	0.464	3.21	0.274	2.00	41%
DHM 813-1	0.700	1.57	0.257	1.27	63%
BHLA 365	0.750	2.23	0.440	2.43	41%
KK-X58	0.332	2.25	0.268	2.43	19.3%
KKY 146-28	0.292	1.37	0.223	1.93	23.6%
DHS B101	1.390	—	0.482	2.28	65.3%
KKY 145-48	0.350	—	0.243	2.07	30.6%
KKA 4-1	0.236	1.36	0.202	2.05	14.4%
BVWD 82-1	0.898	1.57	0.297	2.18	66.9%

Russia ahead of U S in some automating techniques: Unksov

Soviet Russia is ahead of the U S in some fields of automation, and it doesn't lag far behind in others. That's the gist of remarks made by Professor Eugene Unksov, director, Central Scientific Research Institute of Technology, Moscow, in a New York press conference.

Said Professor Unksov:

- Nearly 50,000 workers will be transferred to new jobs within a year or two because of automation.
- Some 50,000 machine tools will be bought under Russia's new Seven-Year Plan.
- Automation of Russia's ball-bearing plant has increased production there 100%.
- The Russian government finances 50% of all plant improvements and additions, while the industry concerned finances the other 50%. This new practice avoids top-heavy planning and overexpansion by the state.
- Continuous casting of steel and automatic rolling mill controls are far more advanced in Russia than here, according to Professor Unksov, who adds that Russia knows much more about cooling rates in heat treating of such large work as castings and turbine shafts.

Russia today feels that its accomplishments in developing automation techniques are sufficiently advanced to warrant its holding a "First" International Conference on Automation in Moscow next year. And, he added, because of automation, output in the first six months of 1959 (the first year of the current Seven-Year Plan) is running so far ahead of schedule that gross USSR production will exceed that of the U S in some fields when the Plan ends.

Vacuum ladle-degassing differs from vacuum stream-degassing and vacuum arc-furnace degassing in that, after pouring, the filled ladle is placed in a vacuum chamber. It is said to be the least expensive method developed to date. Ladle is filled (left), vacuum treated (center), and degassed steel is poured into molds (right)

For less than 1c per pound:

Degassed die-block steel

Degassing steel on a production basis for die blocks and forgings costs less than one cent per pound, according to A Finkl & Sons Co, Chicago. Company tests show that its new ladle degassing process removes 60% of the microcracking that is caused by hydrogen.

Oxygen and nitrogen gases are also removed by the process but the hydrogen, which causes flaking and small cracks in steel, is particularly troublesome in die blocks. Removing the oxygen and nitrogen provides a cleaner steel and, by minimizing hard oxides and nitrides, improves machinibility and heat treatment.

Degassing in the ladle

With the Finkl process, steel is vacuum degassed in the ladle. After degassing it can be poured into one or more molds by moving the ladle from one mold to another, an ability of particular interest to foundries.

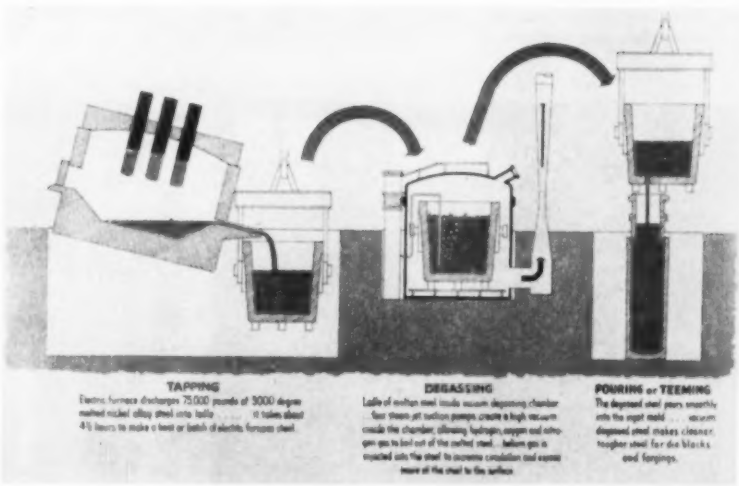
In sequence, steel is poured from the electric furnace into a ladle, the entire ladle is placed in a large vacuum degassing chamber, the chamber is covered and sealed, and the degassing cycle is started. For the demonstration, Finkl used a ladle containing a 75,000 lb batch of steel.

How vacuum is created

To create the vacuum, four steam ejector suction pumps are turned on in proper sequence by automatic controls. As the pressure in the chamber drops, hydrogen gas, along with the oxygen and nitrogen in the steel, bubbles to the top and is drawn out by the pumps. A powerful turbulent boiling action develops on the surface of the molten steel. Turbulence increases as helium gas is injected into the steel in the ladle to scavenge even more gas.

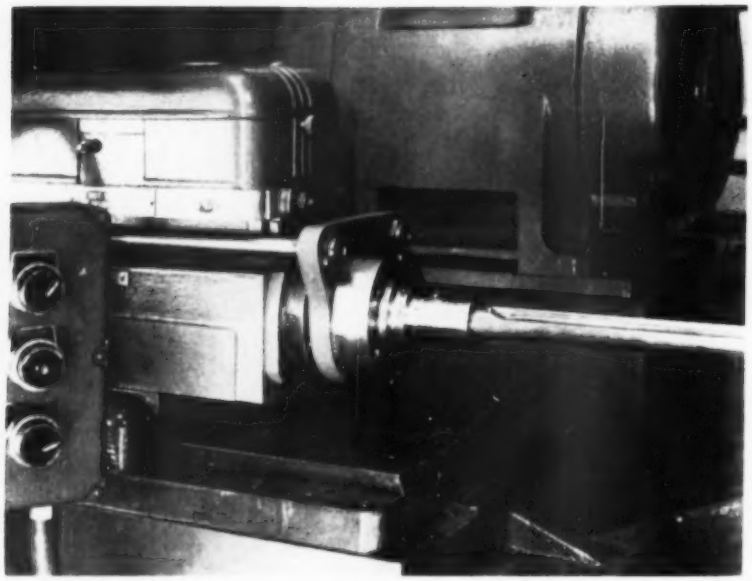
Then the pumps shut down, air is returned to the chamber, the cover is removed, and the ladle is withdrawn. In 12 minutes the entire cycle is complete and the steel has lost very little temperature. Actually, it is poured into the ingot molds at about 2850 F. The company has also found that degassed steel can be poured at about 30 F lower than non-degassed steel.

A Finkl & Sons Co, a major supplier of die blocks and forgings, produces approximately 35,000 tons of electric-furnace steel per year, of which 90% is alloy and 10% is carbon. With degassing, to date, done only at the request of the customer, more than 80% of the alloy steel is degassed.



Finkl ladle degassing process

Mechanized gun drill saves

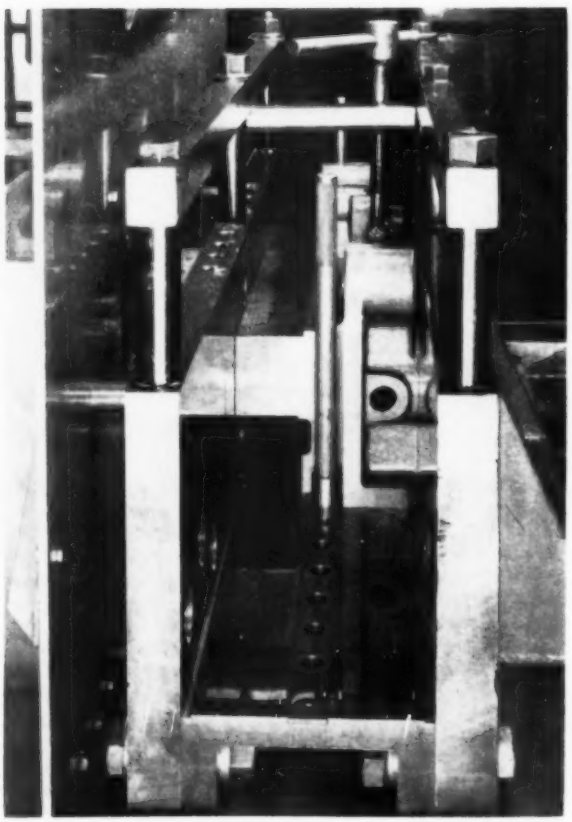


Gun-drill head . . .
cuts ⅝- to 1-in. holes up to 4 in. deep in alloy cast iron. Spindle speeds are 1200-1500 rpm; feed is 6-8 ipm; stroke is 4.5 in.

Fast gun drilling saves 40% on labor and produces fine finishes and high accuracy at Emhart Manufacturing Co, Hartford, Conn, where valve bodies for glass-making machinery are being produced. As many as 51 holes are drilled in the cast-iron blocks, some holes to tolerances of ±0.000,25 in.

Tooling is based on a Morris Air-Oil-Matic drill unit coupled with an Emhart-built indexing fixture. Work is mounted in the fixture, located with removable pins in holes in the fixture base. Hole patterns in the work are staggered horizontal rows, so the work is shifted manually to touch locating pins, then clamped. A second or third row of holes is located the same way with the fixture baseplate raised to position the work. Drills and bushings are changed when workpieces with different hole requirements are produced.

Mechanized gun-drilling machine . . .
has adjustable load control that shuts it off for dull or chipped drills, hard spots, or insufficient coolant. Coolant at 1000 psi is shut off on return stroke



Work is fixtured . . .
between vertical plates and held by pins in holes in bottom plate. Work is lifted for a second row of holes by raising bottom plate

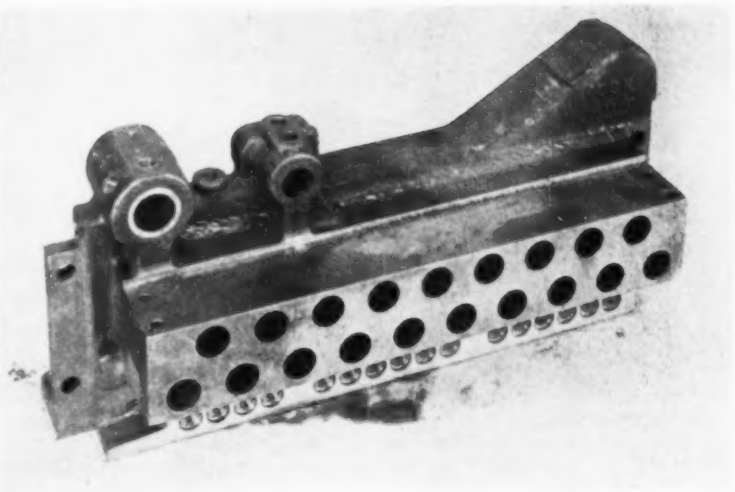
40% on CI blocks

The drilling machine has oil control, air power for the stroke, which may be as long as 9 in. Spindle speeds up to 5000 rpm are available, and feed may be as high as 40 ipm.

Adjustable load control stops action and retracts the quill in case of broken or worn drills or jammed chips. This feature also helps determine proper cutting-tool grind for the job at hand.

In addition to saving 40% on labor and to holding close dimensions, the setup has saved 30% in time because it can handle drilling operations that formerly required several machines.

The machine includes a coordinated high-pressure coolant and chip-removal system that is integral with other Emhart gun-drilling installations. Coolant can be pumped at 30 gpm, delivered through magnetic separators and filters that remove all solids down to 5 microns.



Glassworking valve blocks . . .
are ASTM-A-48 class 35/40 alloy cast iron. Holes are 1.000 ±0.0005 in. and 0.625 ±0.0025 in. all 4 in. deep, and 0.624 ±0.005 in. to a blind depth of 2.500 in.

Predict six months' rise in machinery orders

Machinery New Orders Forecast*

(1950 = 100)

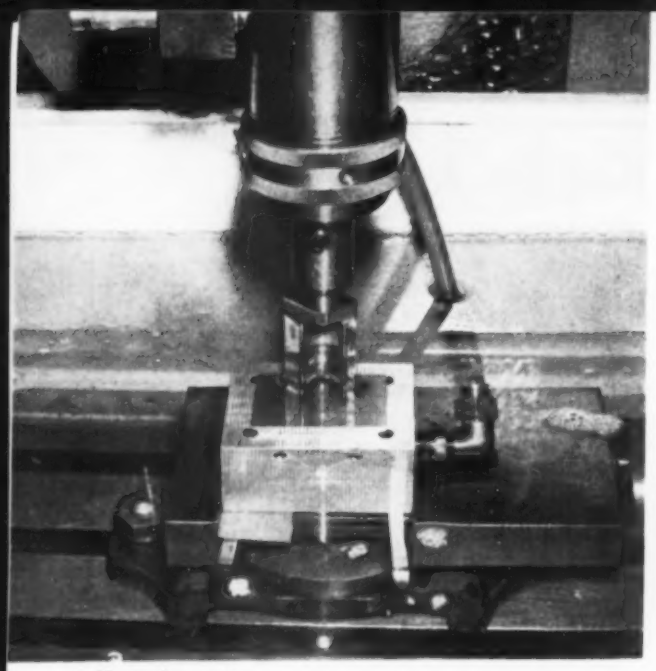
	Total Machinery							
	Unadjusted	Seasonally adjusted	Pumps & compressors	Engines & turbines	Construction & mining machy	Metalworking machinery	Other Ind. machinery	Office machinery
1959								
IQ	176	168	233	197	196	150	163	196
IIQ	185	178	252	208	215	190	164	196
IIIQ**	165	181	239	194	192	152	145	179
IVQ**	182	182	243	201	205	191	161	210
1960								
IQ**	192	184	256	214	225	198	171	197
IIQ**	182	175	265	215	219	182	155	205

* McGraw-Hill Dept of Economics
** Forecast made in mid-July 1959

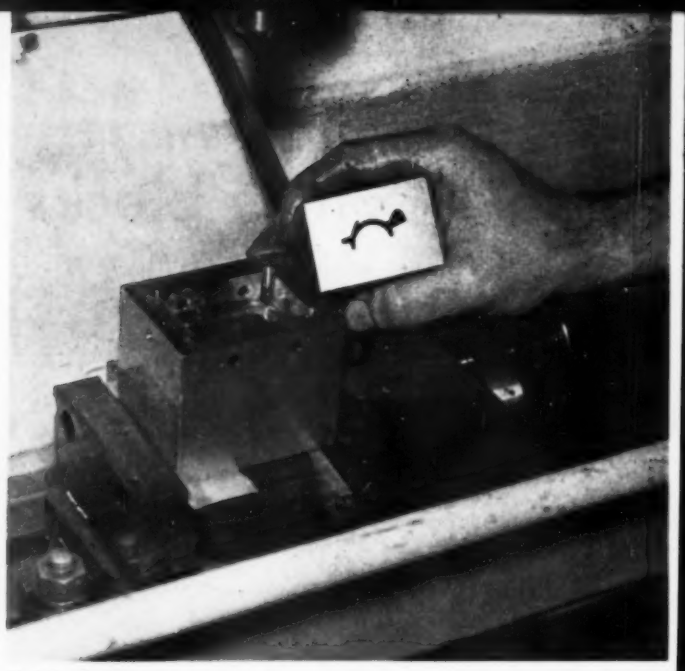
A sizable increase in new orders for machinery (except electrical) is expected by capital goods producers cooperating in the quarterly McGraw-Hill Machinery New Orders Forecast. And a further gain is expected in the first quarter of 1960. The upturn in the final quarter of this year will spread over all the products represented in the forecast—pumps and compressors, engines and turbines, construction and mining machinery, metalworking machinery, office machinery, and other industrial machinery. Upward turn in the first quarter also will apply to all of these categories except office machinery.

Biggest jump of all in the fourth quarter will be in metalworking machinery, including machine tool orders. From 152 (1950=100) in the third quarter, bookings are predicted to rise to 191, and then in the initial quarter of next year to go to 198. Office machinery orders will increase from 179 in the current quarter to 210 in the fourth quarter. The over-all machinery index, unadjusted, will go up from 165 at present to 182 in the October-December period and to 192 in the January-March 1960 period.

Drop off of 10 points in the machinery index is forecast for the second quarter next year.



Electrojet setup . . .
Silver-tungsten electrode machines a trimming die. Transparent liquid here represents usual oil bath that covers work



Finished die . . .
Cavity is about 1 in. long, through ½-in. die steel, with parallel walls and high surface finish

Spark diesinking saves time

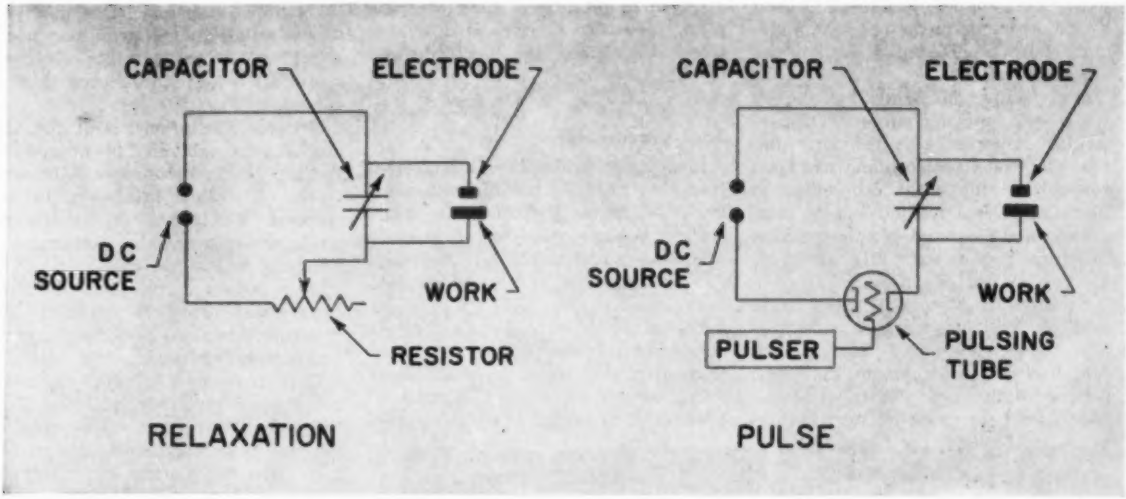
By Bruce Minturn, The Cincinnati Milling Machine Co, Cincinnati, Ohio

Die-cast electrode . . .
Zinc works as a die-sinking tool, usually without further refinement to the die-cast shape

Electric-discharge machining saves diesinking time and expense when hardened forging dies are formed. This relatively new machining method is making rapid headway in heavy-duty diesinking, an area that allows substantial cost savings because total investment in forging dies mounts up so rapidly.

One advantage of EDM is that it can machine hardened die blocks, to eliminate the danger of distortion, cracking, decarburization, and such caused by heat treatment after conventional machining. In addition, the finished crater machined by EDM requires less bench finishing time than milled cavities. In fact, some forging dies require no bench time at all. Typical roughing finishes are 140 mu in., and typical final finishes are as close as 80 mu in.

The process is mechanized to a considerable extent, too, which saves operator time. An electrode is advanced into the work by a servomechanism that operates as metal is removed. The machine can operate unattended for long periods of time; one operator can serve several installations. There is also minimum danger of operator error, because—once the electrode is prepared to the necessary shape and is operating—a wrong cutter or oversize cut, as in milling, is less possible.



Two different circuits . . .
Relaxation circuit at left is a resistor-capacitor arrangement. Pulse circuit requires more equipment; can control frequency with greater accuracy. Advantages seem to more than justify walls and high surface finish

before forging

Usually, electrical-discharge machining becomes economical with lot sizes of 5 to 15 pieces of either new dies or reworked dies. Greater economics are achieved when one operator can tend several diesinking machines.

Mechanical problems

One question people have asked, "Why put a heavy, miller-type, rigid head on an electrical-discharge machine when there is no cutting force on the electrode?"

While it is true that there is no *cutting* force, the dielectric fluid used to flush away eroded metal is under pressure—up to 100 psi. A 20-sq-in. electrode area can have a ton of force tending to separate it from the work. Unless this force is resisted, the extremely important spark-gap distance will constantly change and both accuracy and cutting efficiency will suffer. As with any other metalworking process, nothing can be taken for granted.

Two basic electric-spark processes are used in America today. One employs a relaxation, and the other a pulse circuit. The relaxation circuit is electrically simple; the pulse circuit requires the use of vacuum tubes or static-switching devices. Both will do a satisfactory job on many applications, but on heavy-duty jobs where a combination of good surface finish and fast metal removal rate are critical, the pulse circuit is much better.

The relaxation circuit is also known as the R-C (resistance and capacitance) circuit. The pulse circuit is sometimes called a triggered circuit.

The R-C relaxation circuit produces high-energy sparks at low frequency. It operates on the principle of self oscillation, pulsing 3000-10,000 times a second. The pulse circuit is capable of operating at 10 times the speed of the self-oscillating circuit. Because the pulse circuit operates at a higher frequency, it can use a lower-energy-level spark to remove the same amount of metal.

As the R-C circuit uses a higher-energy spark to make up for its inherent low frequency, a much rougher surface finish and a deeper penetration of disturbed metal on the surface of the work is the result. In addition to creating a higher-energy-level spark, a high voltage across the tool and work is usually necessary.

Overcut

Spark energy is closely tied in with over-cut of the electrode. Overcut is the distance that the spark penetrates out from the tool and removes metal from the work. The higher the energy level of the spark, and the higher the voltage, the larger the overcut.

If an RC and a pulse machine were both equipped with square electrodes and adjusted for equal removal rates, the pulse circuit would machine a much sharper corner than the R-C circuit because of its shorter over-cut. Obviously, the circuit that reproduces the electrode shape with the least over-cut will give the most precision.

Of course it is possible to reduce the energy level of the spark in the relaxation circuit and get "precision." But then the two machines in the example will no longer be equal in stock removal rate.

All the machining energy in these machines is applied through an electrode which never touches the work. We have come to realize that there is more to consider about an electrode than just free machining properties, or proper size and contour. In particular, the electrode is an electrical component of the circuit, so that its chemistry, the chemistry of the work, and that of the dielectric fluid in which both are bathed will affect machining performance.

Electrodes

Yellow brass has been the workhorse electrode of the pulse circuit,

while pure copper is commonly used as the electrode in the relaxation circuit. Neither performs as well in the alternate circuit.

Many other materials have been tried with varying success. Of particular importance is the zinc die-cast electrode, which alone has been responsible for great economies in diesinking. Heat-treated forging dies, die-casting dies, and plastic-molding dies have been successfully machined with this electrode material.

Zinc has relatively low shrinkage and low melting temperature. It is also readily available, and can be remelted and used repeatedly. Close control of the cast electrode can be maintained by pouring the molten metal in a preheated mold and applying pressure as it cools. For still closer tolerances, the electrode can be annealed and given a second pressing.

Tool procurement

Most dies require four to six electrodes to produce the finished cavity. This creates a problem in registration. Among other techniques under development now are methods for casting locating contours into the electrode.

Electrical-discharge machining is also used to manufacture punching, trimming, and stamping dies. However, proper electrodes cannot be purchased like so many drills or milling cutters, so often the economy of a job will depend upon the user's ability to select suitable electrode materials and manufacture them to shape.

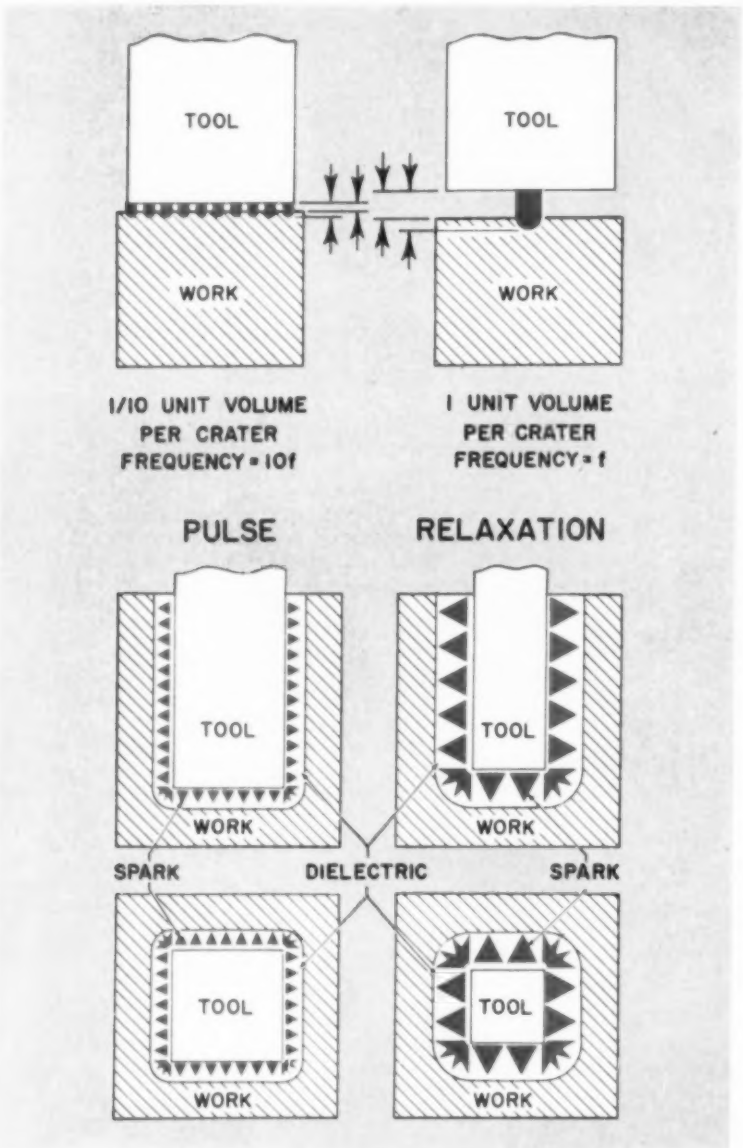
Because the precision of the machined part can only be as good as the precision machined into the electrode, it is advantageous to use stepped electrodes. A three-step electrode is a rough, medium, and finishing tool all in one.

New low-wearing electrode materials such as silver tungsten, copper tungsten, and metalized graphites are being used.

One time-saver trick is to attach a piece of electrode material onto the end of the punch by brazing, or bonding with conducting epoxy resins. Then the punch and the electrode tip are machined simultaneously to the desired shape. After machining the dies, the electrode material tip is detached from the punch, and the job is complete. On occasion, it is possible to eliminate brazing by using the steel punch itself as the electrode.

Another ingenious diemaking technique has been developed for mating the punch and die. A piece of electrode material is placed under the die and as the electrode passes through the die, it penetrates the electrode material. Then, the rough-machined punch is placed in the machine quill in the place of the electrode, and the die is removed from the machine table, leaving only the electrode material that had been penetrated with the die form. The electrical leads are reversed and the previously roughed-out punch is servo-fed into the electrode which is now on the machine table. In this way, the punch is machined to the mating size of the die.

It is still a difficult problem to determine the proper size for an electrode to compensate for both overcut and electrode wear. At Cincinnati Milling Machine Co. over-cuts of about 0.0015-0.0008 in. on fine-finish settings and 0.005-0.007 in. on rough-machining settings have been achieved. Tapered sides can be held below 0.002 in. per in., if care is taken in selecting the proper electrode material, and if the electrode is properly designed and located in the machine quill.



Different action . . .
Pulse method (left) produces finer cutting action. Overcut (lower sketches) is something like an inverted plating problem; doubled action at the corners may reduce accuracy of the contour

EUROPE'S *mushrooming* AUTO INDUSTRY

1953	1957	1958	1959
2,026,000 CARS, TRUCKS, BUSES	3,703,848	4,479,000	4,875,000

In just five years, European automotive production has doubled, exports have zoomed, and branch assembly and production have spilled over into the four corners of the earth. Domestic demand is growing fast as the peoples of Europe better their standards of living.

WHAT WILL THIS DO TO AND FOR U S METALWORKING?

SPECIAL WORLD INDUSTRY *REPORT NO 477, August 24, 1959*

Europe's output has doubled since 1953, is still growing

So fast is Europe's automotive industry expanding that it is not only difficult to estimate its true size today—it is virtually impossible to guess how big it will be, say, five years from now.

European automobile manufacture has more than doubled in the last five years and the saturation point is nowhere in sight. There is today, for example, only one passenger car for every 8.5 people in France, only one car for every 25 people in Italy, compared with one for every third person in the U S.

Add to that three salient facts: (1) incomes are rising fast in Europe (4% a year in Italy, for example), (2) installment buying is available in most European countries now for the first time on an appreciable scale, and (3) year-by-year European automakers have been grabbing off a larger share of world markets.

The result: a continuing boom.

This year, Europe's Big Five automotive manufacturing nations (West Germany, Great Britain, France, Italy and Sweden, in that order) will turn out something like 5-million cars, trucks and buses. American output will top 7-million units. **This means that European production is today equal to 72% of American output.**

To meet rising domestic and export demand, Europe's automakers are turning more and more to automated processes and high-production machines. Much of this equipment comes from Europe itself, but there is, too, a growing market for American-made capital goods.

Growth of industry in western Europe, including the automobile industry, is responsible for heavy investments of U S manufacturers in that area. Foreign capital expenditures of U S industrial companies are expanding more rapidly in western Europe than in any other area, according to a study just completed by the McGraw-Hill Department of Economics. Next year U S manufacturers plan to invest more in new facilities in Europe than in Canada and Latin America combined.

The McGraw-Hill study is based upon reports from U S manufacturing and petroleum companies who represent about 75% of US metalworking capital spending overseas.

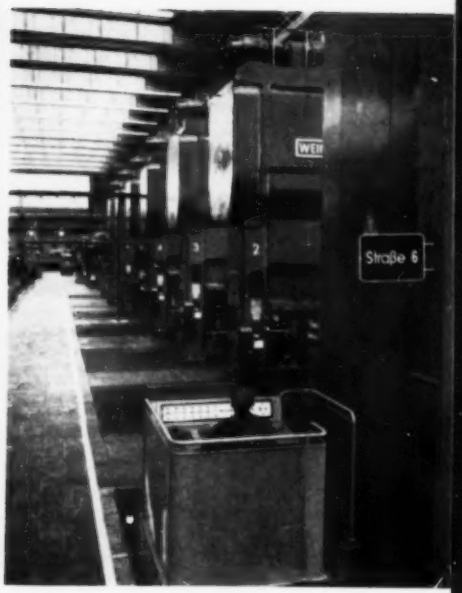
In the metalworking industries, investments planned abroad are heavily weighted in favor of western Europe. Metalworking companies that cooperated in the study will make a total outlay of $464 million in countries outside the United States during 1960. Of that amount $303 million will be spent in western Europe. Firms in the transportation equipment category, including automobile companies, will pour $122 million into facilities in western European nations. Industrial and electrical machinery manufacturers will make investments in the European sector of $166 million. Companies in the transportation equipment and machinery groups plan to spend two-thirds of their total 1960 outlays overseas in Europe. Combined, they account for almost 70% of present plans reported in all manufacturing industries for expenditures in Europe next year.

On the following pages is an up-to-the-minute, on-the-spot report of the close infighting among Europe's Big Five auto-producing nations. The prize: a lion's share of the world auto market.

EUROPE'S TOP DOZEN

(Car, truck and bus production)

	1958 (actual)	1959 (estimated)
Volkswagen (Germany)	553,400	650,000
British Motor Corp (England)	504,700	580,000
Renault (France)	411,000	510,000
Ford of England	357,000	410,000
Fiat (Italy)	348,700	450,000
Opel (Germany)	315,945	330,000
Citroen (France)	241,000	287,000
Simca (France)	201,000	246,000
Peugeot (France)	188,714	207,000
Vauxhall (England)	174,616	200,000
Rootes Motors (England)	150,000	180,000
Daimler-Benz (plus Auto-Union) Germany	156,500	175,000



Germany's best-selling Volkswagen has achieved international repute . . .

. . . as "a lot of car for the money" because Volkswagen has been able to keep quality up and prices down through extensive use of automation in assembly (left), machining, and in such installations as (center photo) a battery of three automatic, 150-ton specially built presses for auto roofs, and (right) six fully automatic press lines with 31 presses

WEST GERMANY: heading for an all-time European output record in '59

By Jim Morrison
American Machinist Bonn Bureau

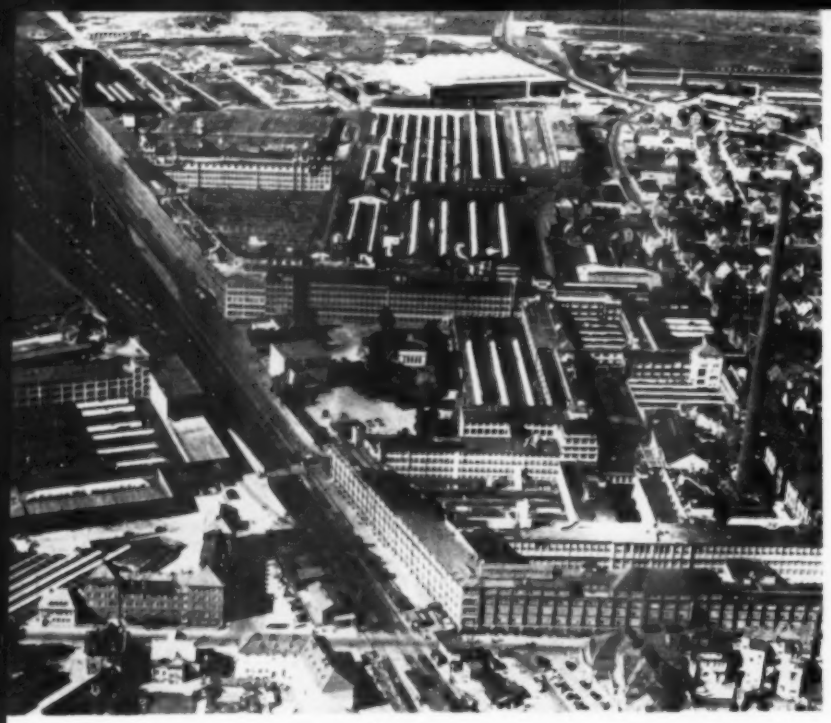
Perhaps the prime example of growth is to be found in West Germany. Here, heavy investment in new plant and equipment, plus maximum exploitation of automation and all it has to offer, has trebled output in the last five years—from 493,000 passenger cars (this figure includes station wagons and minibuses) in 1953 to 1,495,000 in 1958. And if all goes well with Germany's automotive industry this year, more than 1,680,000 cars will roll off the lines, an all-time European record for any one country.

Of this total, Volkswagen will produce 650,000 vehicles; Opel (a GM subsidiary) 330,000; Ford of Germany 142,000; Daimler-Benz 105,000, and Auto-Union (a Daimler-Benz subsidiary) around 70,000 units.

Each of these companies is at the top of a pyramid of parts manufacturers and other supplier industries. Just how self-contained each automaking firm is varies from nameplate to nameplate and model to

Largest bus plant on the Continent . . .

. . . is that of Daimler-Benz at Mannheim, Germany. The 6.3-million-sq-ft plant not only produces several types of local and long-distance motor coaches, but medium-sized trucks as well. Daimler-Benz has five plants in Southern Germany with a total area of 31.5-million sq ft, employing 83,000 people, also controls Auto-Union, fifth-ranking German automaker



Biggest plant in the entire GM setup . . .

. . . (and that includes plants in the U S) is the 1,467,000 unit-a-year GM-owned Opel plant. The plant, said to be the second most productive of all GM plants, relies on such modern machines as the US-made Micromatic Hydrohoner (right) for high-production of the full line of Opel cars and trucks. Customer orders the type, color, upholstery, etc. that he wants. Order is transferred to a punched card and details on the card are transmitted to the various departments by teletype. Departments make each component as ordered, then deliver it at right time and in correct order to the assembly line

model. For instance, Daimler-Benz might easily produce 40% of the parts needed for a standard model, but on a trickier model would go outside for 70%.

Ford Motor Co at Cologne estimates that it produces 30% of the parts for its two most popular models itself. **Because of the high ratio of farmed-out manufacture in Germany, the parts industry almost equals the auto industry itself in annual dollar volume of sales.**

Prefer locally made parts

German-owned automobile companies shy away from using made-outside-Germany parts. This is less true, however, of foreign-owned auto plants in Germany. Italy's Fiat, for instance, ships bodies to its subsidiary in Hildesheim, Germany.

Germany's NSU imports bodies for its four-seater mini-car from Italy solely because it couldn't get Bertone of Turin to design the body without having it made in Italy. But NSU's contract expires any day now and plans are under way to produce the bodies at NSU's own plant in Neckarsulm.

Volkswagen and Daimler-Benz maintain extensive, well-run plants and installations abroad. Daimler-Benz has production facilities in Brazil, India and Argentina, plus full-scale assembly plants in South Africa, Australia and the Philippines, and small-scale assembly plants in Belgium and Denmark. Its sales network includes 185 authorized importers in other countries and 1600 distributors.

Contrary to general belief, Volkswagen's international network is not quite so extensive as that of Daimler-Benz. However, it does have assembly plants in Belgium, Ireland, Mexico, Brazil, South Africa, the Philippines, New Zealand and Australia. The Brazilian plant will soon produce 90% of all parts required for its output, with the remaining 10% coming from Germany. The Australian facility will one day produce 70% of the parts it needs.

Germany's three other major producers—Opel, Ford and Auto-Union—pretty much confine their facilities within the country. General Motors' Opel plant at Russelsheim, largest in the entire GM setup, is self-contained, has no subsidiary plants in Germany or elsewhere.

Ford of Germany maintains much the same attitude but does have a small assembly plant in Austria.

Auto-Union, Germany's No. 5 producer, recently taken over by Daimler-Benz, has been too busy equipping and building its new plant at Ingolstadt to devote attention to setting up assembly and production plants outside Germany. It has its eye on the U S market, may either organize an extensive distribution and sales network of its own or become part of the worldwide Daimler-Benz sales setup. Its single subsidiary (in Argentina) is expanding fast, already makes 50% of its own parts. The rest come from Germany. The plant will not be in full production for three years.

Germany today claims to be the world's top exporter of automobiles. In the first three months of this year, it exported 198,488 vehicles, an increase of 7.3% over comparable 1958.

Dislike Common Market

The Germans take a dim view of the European Common Market, even though they are members. In a recent speech Volkswagen's General Director Heinz Nordhoff said the Common Market is "unfree." He pointed out that West Germany sets no quota on automobile imports and exacts only a 20% duty. Yet imports of German cars into other member countries are under strict quotas, plus a 65% import duty in France and 62% in Italy. **Result is that Volkswagen will probably sell only 1800 cars in Italy and 400 in France this year, while Italy's Fiat expects to sell 100,000 units in Germany, and France's Renault 40,000.**

Germany exports half of its vehicle

production, mostly to other European nations, which last year bought 365,200 units (compared to 266,943 in 1957). But less than one-third of total exports go within the European Common Market, whereas Sweden alone bought 84,838 German cars.

Next to Europe on Germany's export list comes North and South America (235,790 cars last year alone.) Top customer was the United States, with 142,984 automobiles, followed by Canada with 33,152.

Capturing British markets

German auto sales have cut deeply into the province of the English automaker. South Africa bought 64,606 German cars in 1958, to cite just one example.

Germany's foreign trade isn't a one-way-export-only street. Last year, German motorists bought 63,697 foreign-built cars, 43,000 of which came from Italy (mostly Fiats).

At present, slightly more than 2.5-million automobiles, station wagons and minibuses are registered in Germany, and this figure should increase 800,000 by year's end. Even so, West Germany still has one of the lowest car-to-population ratios in Europe: one car to every 18 people. By 1870, German authorities believe this will have been raised to one car for every eight people. **Automakers claim they will sell 1-million cars in the domestic market in the years 1965 to 1970.**

Phoenix from WW II's ashes

The German automobile industry has come a long way in a short time. At World War II's end, the German motorcar industry had virtually been wiped out. A scant dozen years later, Opel, Volkswagen, Ford and Daimler-Benz were pouring $125 million into plant and equipment capital in one year alone. Volkswagen is currently topping its all-time investment highs with an outlay of $120 million more this year and next. German Ford is investing another $75 million to break its remaining production bottlenecks. Daimler-Benz spent $28 million last year to boost its output to 10,000 vehicles a month.

West Germans today are living better than they did five years ago, but the man in the street still has to count his pfennigs carefully if he is to keep up with the Schultzes.

Prices of food and other basic commodities have shot up in recent years. Because it is fashionable to have a TV set and go to Italy on vacation, many Germans are living beyond their means. Even so, Germans today would rather have the bigger $^3/_4$ and 1.125-liter-capacity cars than the small 500 or 600-cc jobs so popular a year or two ago . . . and Germany's automakers are acceding to public tastes. Example: 52.8% fewer cars of less than $^1/_2$ liter capacity are being produced this year than last.

Today, 43.3% of the new vehicles in Germany are bought by people in the lower wage brackets, the same group that bought 61.1% of the used cars offered for sale last year.

German car manufacturers are against U S-style annual model changes. One reason is that the used car market is a thriving one. Common German practice is to trade in an old car as part payment on a new one or for a more recent second-hand model (just as it is here). German automakers reason that if new models are introduced every year, old models outdate too rapidly, are hard to sell on the used car market. Normal progression to the ranks of new car owner in Germany: (1) motorized bicycle, motorcycle or scooter, (2) an old "junk," (3) a late-model used car, (4) a small new car, and (5) a bigger new car, the size of which depends upon the strain the owner's purse can stand.

This progression, with the possible exception of the initial motor-bike-scooter phase, is just about the same as in the United States but German car manufacturers can't see it as an excuse for every-year model changes. Rather, industry leaders make model changes every four to seven years, although modifications go on continuously. The 12 M Ford, for instance, hasn't changed basically since it came out in 1952, and there is little chance that it will in the next two to three years.

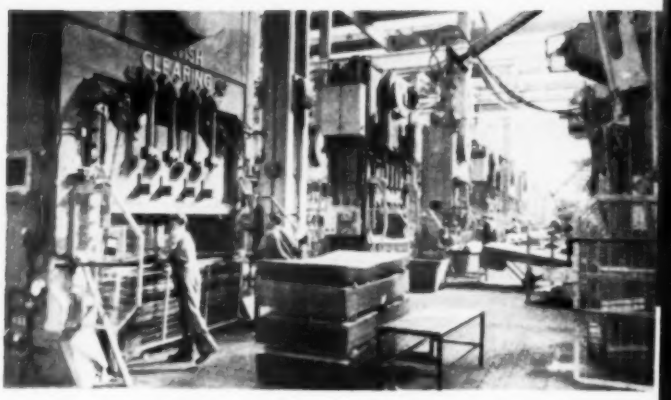
Last year, something like 272,500 vehicles were bought by Germans on the installment plan, with the average buyer getting $580 in financing from private companies. Credit maximum is 24 months. Probably less than half the cars bought on the installment plan in Germany have been new cars, which leads to the conclusion that roughly one-tenth of all new vehicles registered were bought on the hire-purchase plan, the rest having been bought for cash.

To meet demand, German automakers are *cutting down* on the workweek from three shifts, six days a week, to two shifts five days a week . . . and they're doing it by investing heavily in new machine tools, presses and automation equipment.

Result is that present capacity of the industry could quickly be increased 7 to 10% without employing additional labor.

Transfer line for automatic machining of cylinder blocks . . .

. . . is part of the ultramodern plant of Ford of Germany near Cologne on the Rhine river, which has 2,465,000 sq ft of manufacturing space, employs 15,000 people. Since 1948, more than $100 million has gone for new plant



Pressed Steel Co makes bodies for half of England's car output . . .

. . . something like 8000 of them a week. This firm, one of the world's largest independent auto body makers, also does a big business in railway rolling stock and refrigeration equipment. Pressed Steel achieves mass production by employing a high degree of automation and by keeping its processes simple and repetitive so that semi-skilled workers can do the job. Company has four plants, employs more than 16,000. Large photo and photo top right show machine shop and body assembly line at the main Cowley plant. Photo right bottom shows line of British Clearing presses in the Swindon paint

GREAT BRITAIN: trouble in world markets may take the bloom off the boom

By John Tunstall
American Machinist London Bureau

The booming British auto industry, second only to West Germany in Europe, has doubled its output since 1953, and expects to exceed by a fairly comfortable margin its 1958 production of 1,052,000 passenger cars and 360,000 trucks. About half of all British automotive production is exported today.

Britain's five major automaking firms—British Motor Corp, Ford of England, Rootes, GM-owned Vauxhall, and Standard—produce about 95% of the country's total automotive output. The rest is divided among producers of luxury and specialty cars: Jaguar, Rover, Daimler, Rolls Royce, Armstrong-Siddeley and a few other firms.

Lion's share of the domestic market—42% of new car registrations last year—is held by British Motor Corp (BMC), maker of Austin, Morris, and MG among others. This company employs 55,000 workers, last year attained an annual production of 500,000 vehicles, including 130,000 trucks.

Next in line comes Ford of England with an annual passenger car and truck production of about 357,000 units in 1958; then Rootes Motors (Hillman, Humber, Singer, Sunbeam) 261,000; Vauxhall (GM's British subsidiary) 174,616; and Standard (Triumph, Standard) 79,875 units. **Each of the five companies expects to do 20 to 25% more business this year than last.**

Network of parts makers

Feeding Britain's automotive giants with components and accessories is an extensive, overlapping manufacturing and subcontracting network. For example, a major auto industry regrouping in postwar years saw the disappearance of independent body makers as they were absorbed by the Big Five automakers. All disappeared, that is, except one —Pressed Steel Co of Oxford. **It today is the largest independent body maker in Europe, employing 10,000 people to produce roughly half of total British car bodies (468,000 last year).**

BMC still subcontracts about half its body work, including the lucrative Morris Minor contract, to Pressed Steel, even though BMC has recently acquired Fisher and Ludlow body-making facilities.

Rootes makes the body only for its Humber, gets almost all the rest from Pressed Steel. But Pressed Steel is losing some of its body work as Standard now makes its own in a new plant, while Vauxhall and Ford do their own body work.

The latter company is the most independent and self-contained of

the British auto producers. Since taking over the Briggs Body Plant at Dagenham in 1954, it has made all its own bodies there.

Britain's major manufacturers are more independent in other component manufacturing fields and do their own assembly work. In engine manufacture only Vauxhall goes outside for foundry and forge work, for engine blocks, crankshafts, connecting rods and gears.

The other companies operate their own foundries and forge shops, supply their own blocks, gears, connecting rods and crankshafts, but all major British automakers subcontract pistons, rings, bearings, valves and springs, and at least part of their axles and differentials.

Lucas Inc supplies almost all the electrical systems and equipment to Britain's Big Five, while Girling and Armstrong share the damper business, Dunlop makes wheels, Ferrodo brake linings, Vanderwall makes thin-wall bearings, and Wellworthy Ltd rings and pistons. BMC gets its carburetors from SU, while Solex and Zenith divide the carburetor business of the other four major automakers.

General Motors-owned Vauxhall plant at Luton, England . . .
. . . produces automobiles, Bedford light trucks, and cabs for bigger Bedford trucks. Cabs are delivered to the Bedford truck plant at Dunstable as needed

WHERE BRITAIN SELLS ITS PASSENGER CARS
(Based on final 1958 figures)

	Number of units purchased	Total value of units purchased
United States	153,000	$176,000,000
Canada	45,000	54,000,000
Union of South Africa	44,000	45,000,000
Australia**	56,000	45,000,000
New Zealand	23,000	22,000,000
Sweden	20,000	20,000,000
Eire	18,000	14,000,000
Rhodesia and Nyasaland	8,000	11,000,000
Malaya and Singapore	8,000	8,000,000
Netherlands	8,000	8,000,000
Other countries*	92,000	96,000,000

*90% of this total was sold to European nations not mentioned above.
**Sales price per unit is lower because cars shipped CKD

Labor troubles since WW II

Britain's almost wholly unionized auto industry has the nation's most militant unions, with the result that much of the industry has been beset by labor troubles since world War II. Pay rates are not the sole source of trouble—the unions have made attacks on general management policies.

Neither Ford nor Vauxhall works on a piecework basis. Ford has a basic hourly wage rate supplemented by a merit rating for each worker according to grade, which can raise a worker's hourly figure as much as 20%. Ford's assembly workers operate alternate night shifts which pay 1-1/3 the hourly rate. Average Ford workweek is 42½ hours. GM-owned Vauxhall has a similar wage setup, while BMC and Rootes operate on a basic minimum hourly rate with a piecework bonus.

Throughout Britain's automotive industry, labor is divided into: (1) skilled workers, (2) semi-skilled, and (3) unskilled workers, who comprise about 80% of the labor force.

Basic hourly rates for the three grades vary little. A semi-skilled worker gets about 90¢ an hour and an unskilled worker 77¢. A highly-skilled tool setter or machinist with bonus gets around $66 a week, only $15 or so more than a semi-skilled worker. **Low as they are by U S standards, these wages are 40% higher than they were in 1953. But the rate of increase is now slowing.** In all, Britain's automotive industry employs around 323,000 people, while auto supplier industries have another 177,500.

Most of Britain's Big Five have just completed extensive modernization and expansion programs. Most spectacular is Ford's five-year, $225-million program, slated for completion this year. Vauxhall is spending $150 million. **At least three of the Big Five plan to increase tooled-up capacity by 25% the next couple of years to meet a demand that is growing at a rate of 20 to 25% a year.**

Planning beyond that date is uncertain until the effects of the European Common Market and the entry of the USA's Big Three into the small car market are known (European Common Market countries and the United States take half of Britain's car exports).

Several million dollars will be invested by British car makers the next five years in automating body

and engine assembly processes, an area in which Britain lags behind this country. Body welding jigs will replace hand loading and welding. Yet to be introduced in Britain are automatic valve and spring loading, and automatic gearbox assembly. Nevertheless, the British consider themselves "on a par with the U S in transfer machining and ahead in conveyor systems."

British automakers are pretty much in agreement with the rest of Europe in turning thumbs down on U S-style annual model changes. Experts there feel that a body shell is good for three or four years at least, citing the case of the Morris Minor, which is going strong on essentially the same body it had back in 1952 when it was introduced. Lone exception to this "hang on to a good thing and play it for all it's worth" philosophy is Rootes Motors, which says annual styling changes play a big part in its sales successes.

Admittedly, however, this policy of three or four years' model life may go out the window in the next few years if competition stiffens in the fast-expanding world baby car market. From here on out, it won't be so easy for cars to establish themselves (as in the case of Citroen and Volkswagen) on grounds of technical innovation alone, at least without pricing themselves out of business. As novelty and performance differentials diminish, model changes may well be the only way to keep sales up.

Now let's take a look at the market for British cars. First, domestic consumption: Mass buying power has clearly increased in the British Isles in recent years. However, cars now have to compete for the British pound with a whole raft of items never before available to the public on any large scale—refrigerators, TV sets, and even plastic boats, which have caused a spectacular boom in "Sunday sailors." And a lot more Britishers are buying their own homes today.

Automatic marshalling and sequencing of engines and bodies . . .
. . . at Austin Motor Co's (part of the British Motor Corp setup) plant at Longbridge, Birmingham, England, is done by a punched-card system. Engines and bodies travel from manufacturing to assembly through this 1120-ft-long underground tunnel, which accommodates six conveyor tracks—three for dispatch and three for returning empty cradles

This competition from other items is especially important in view of the British tendency to think that any four-wheeled vehicle is OK to get around in—almost a direct reversal of the U S worship of chrome, tailfins, and spectacular horsepower. This form of idolatry, incidentally, is just now showing up among the well-heeled of France, Germany, and Italy. **European liking for small practical cars, it appears, is more a matter of economics and narrow roads than preference.**

Boom in domestic sales

Britain's domestic auto sales are booming today for two reasons—purchase taxes were cut back drastically last year, and installment buying restrictions have recently been relaxed.

But as the domestic market potential continues to grow, British exports (see table) are showing signs of softness in some world markets, notably in other European countries and in South Africa. Admittedly, the British are shipping more cars this year than last, but there is a definite feeling of losing ground in some areas.

British car *and* truck exports are still ahead of Germany's, but West Germany has at last passed Britain in passenger-car-only exports. The two countries are now running neck and neck in the U S Market (about 150,000 units each in '58). Not only that, Germany is cutting down Britain's lead in the truck export field.

Prime mover in the British export market has been CKD ("completely knocked down") shipments of cars to assembly plants throughout the world. Last year, CKD accounted for 42% of all British car exports. All of Britain's Big Five automakers have concessionaire companies in one or more of the following countries: Australia, New Zealand, South Africa, Latin America, Holland, Sweden, Eire and Belgium. BMC, Rootes and Ford of England actually have 10 such plants each.

Because of such intense competition, British automakers today are making radical styling and engineering changes in their cars: Italian-styled bodies, independent wheel suspension, front-engine-front-drive layouts.

The summing up: Britain today is in the peculiar position of losing ground in world markets at the same time that production is increasing and business is booming. Prices must come down at the expense of profit margins if the British are to consolidate or improve their export position. The alternative is more efficient production by use of automation techniques and high-production machine tools.

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Simca's new plant at Poissy, France . . . is ranked as one of the world's most modern. Modernized and enlarged between 1956 and 1958 as part of a $106-million expansion program, the 3.6-million-sq-ft plant has the capacity to turn out 200,000 cars a year. Here, almost every operation is automated—from heat-treating to final assembly

FRANCE: exports are booming but domestic sales may fall off

By Arthur Erickson
American Machinist Paris Bureau

French automakers have plenty of reason to pop champagne corks these days. With a record 1958 already on the books, the industry seems headed for a new high by 1959's end. Last year, for the first time, French production of cars and trucks topped the million mark, while gross profits hit $1.3 billion for a 21% gain over the previous year. An aggressive campaign to increase exports has paid off handsomely for the French. In 1958, France passed the United States to rank third behind West Germany and Great Britain in the world export auto market.

With production already up 11% over record 1958, the situation looks rosy. Still, domestic consumption (which takes two-thirds of output) has slackened. French insiders say that October will tell the tale. **If domestic sales really hit the skids, and many experts think they will, any gains registered in the first half will be wiped out. Brisk export business will take up some of the slack, but the industry would wind up the year only slightly ahead of 1958.**

Four companies—Renault, Citroen, Simca and Peugeot—dominate the French car industry, producing nearly 95% of all passenger cars, 80% of trucks and buses. Government-owned Renault with its 2100-cars-a-day production, ranks third among European automakers and sixth in the world.

Renault exports soar

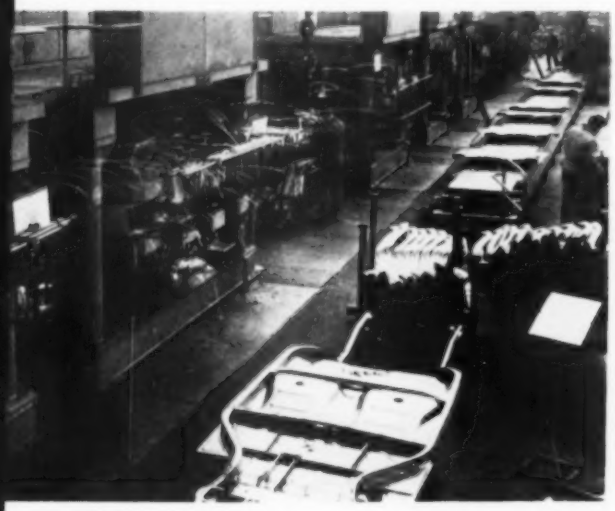
This year Renault has racked up sensational successes in the export market, delivering more than half its production abroad. At mid-year the United States alone was taking delivery of 540 Renaults a day.

Renault's best seller at home and abroad is its Dauphine, which hasn't changed much since it came on the market in 1956. Renault doesn't intend to change it much, either, as long as it continues to sell well.

Since 1954 Renault has more than doubled passenger car output, now operates 10 plants and employs 62,000 workers. Biggest plant is at Billancourt (*AM*—May 4 '59, p119), just outside Paris, where 38,000 workers are engaged in foundry, forge and other manufacturing.

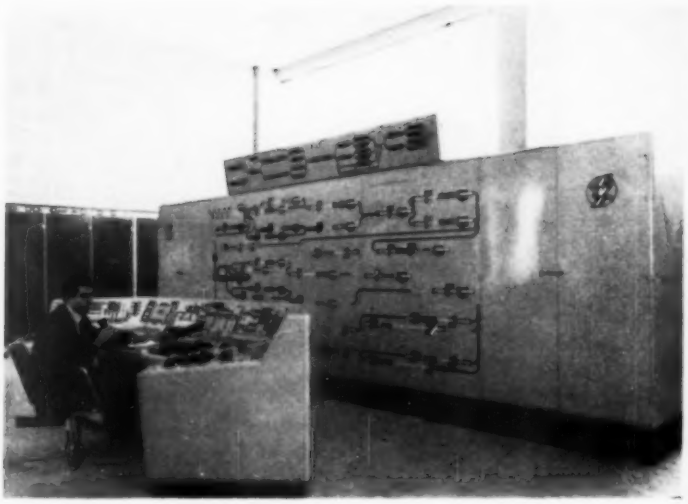
Smaller but in many ways more spectacular is the Dauphine assembly plant at Flins, 25 miles west of Paris, where 8000 workers turn out 1400 cars a day.

Outside France, Renault has assembly plants in Belgium and Great Britain, plus tie-ups with Willys Motors in Brazil and Alfa-Romeo in Italy for the assembly of Dauphines. These, together with contract assembly in Australia, South Africa, Mexico, the Philippines and Ireland, should account for some 50,000 vehicles this year. In all, the company invested $36.4 million in new plant



Welding at Renault . . .

A line of automatic spot welders at Renault's huge Flins plant make the weldment that forms the body baseplate for the Dauphine. Unwieldy parts are placed on the jigs by hand, but once the jig goes into the welder, operation is automatic



Electronic-brain programming . . .

at Simca's Poissy plant directs flow of bodies along five miles of conveyors that make up the paint line. Unit directs each body (there are 35 variations in the Aronde series alone) into proper paint tunnel. Triggers spray guns with specified color

and equipment in the last year alone.

Renault today tends to spread out its manufacturing operations. Twenty years or so ago, it produced about 250 cars a day in one complete, integrated operation. Today, the company is fed materials and parts by 2500 outside suppliers, and the policy is "Buy it outside if we can't make it cheaper ourselves." Some vestiges of prewar self-sufficiency remain, however. Renault, for instance, makes almost all its own transfer equipment, sells enough of it to other automakers and industries to make it the sixth largest machine tool producer in France.

Citroen heads for a record

Next to Renault in total automotive production is Citroen, with 38,000 workers who last year produced 241,000 vehicles (100,000 more than in 1954), chalked up $321 million in sales. Exports for the year ran to 45,000 units.

Citroen this year is headed for a record. Production in the first five months was 118,900 vehicles, 14.5% more than in corresponding 1958. Citroen's domestic sales (contrary to trend) are holding up well, mostly because of a big backlog of orders for the 2CV. Exports are running at about 21% of total production, with Belgium and Switzerland the biggest buyers.

People at Citroen exude confidence when talking about the future. Says one executive, "To survive in the automobile business, you've got to operate worldwide, and that's what we're doing. We think our domestic market is far from being saturated (one car for every 8.5 people today). We expect to be turning out 2000 cars a day in three or four years."

Citroen is backing up its optimistic attitude with a substantial outlay for plant expansion. Work has already started outside Rennes, in Brittany, for a plant that will eventually employ 10,000 workers, will add 1000 units a day to Citroen's present 1500-units-a-day output. Cost of the Rennes plant: $25 million.

Citroen's worldwide acceptance is reflected in its foreign assembly plants, which together turn out 500 vehicles a day.

Characteristic of Citroen, a company that conducts all its operations in as integrated a way as possible, and which shrouds its methods in secrecy, is its attitude toward model changes. "When we come out with a new model, it's so far in advance of other cars that we can go on making it for years."

Variety is the spice a Simca

Ranking third among French automakers, behind Renault and Citroen, is Simca, which last year produced 201,000 cars and trucks to the tune of $400 million sales.

Simca differs from Renault, Citroen and other French manufacturers in the wide range of passenger car models it has to offer—19 basic variations in its three series. **Perhaps that's why Simca has been France's fastest growing manufacturer in recent years, doubling its yearly production between 1952 and 1954, and doubling it again between 1954 and 1958. Today, production per day is above 1000 units.**

Simca, which has a workforce of 32,000, produces its cars and trucks in four plants, also operates a foundry, a forge shop and a nuts-and-bolts works.

Simca's newest and largest plant, at Poissy, has a production capacity of 200,000 cars a year. The plant was modernized and enlarged between 1956 and 1958 as part of a $106 million expansion program. **Consequently, the average age of machine tools at the Poissy plant is less than five years.**

Another plant, at Nanterre, has a 100,000-units-a-year capacity, bringing total annual Simca car capacity to 300,000 units, while another 20,000 units or so are assembled outside France.

Looking forward to even more expansion, Simca has doubled its capital this year, will spend most of the new money to improve production at Poissy.

Like Renault, Simca has pushed exports hard over the last three years with amazing success, jumping from 20,500 units in 1954 to 81,000 in

1958. **And at mid-1959 one out of every two cars coming off the line was tagged for foreign delivery.**

France's No. 4 auto manufacturer, Peugeot, last year produced 188,714 vehicles for a sales total of $272 million. The company doubled its output between 1953 and 1958, this year expects to produce 207,000 cars.

Investment in new Peugeot plant (all self-financed) amounted to $15.3 million in 1958. Over the next two or three years, plant capacity will be increased to 1000 units a day.

Peugeot's operations, which employ 21,500 people, are highly integrated—mainly because the company is part of an industrial group that makes a variety of durable goods, and even some steel.

The Big Four, together with a dozen or so smaller producers, add up to an important segment of the French economy. The auto industry (builders, parts and tire manufacturers) employs 271,000 workers and, of course, is the principal customer of many other industries—buying 14% of the national steel output, 12% of nonferrous metals, 50% of rubber.

No labor difficulties are in sight at the moment. The whole industry, together with other metalworking industries in the Paris area, operates within the framework of a collective-bargaining setup established by the government, unions and management in 1954.

Today, French automobile makers are building more cars than ever before, are well up in the race for world markets, but are worried about the domestic market. French auto men feel that the domestic market is a long way from the saturation point (one vehicle today for every 8.5 people) but that the government's policy of heavy taxation for road-building is hurting sales.

One statistic brought cold chills this May: gasoline consumption dropped off in spite of an increased number of cars in circulation. High cost of gas (76¢ a gallon, 60¢ of it for taxes) is affecting the domestic market. Even worse, the whopping tax bill paid out by the motorist isn't coming back to him in the form of better roads and adequate parking facilities. The auto industry is pushing hard for lower gasoline taxes and good roads. It also wants easier terms for installment buyers, who now account for 40% of new car sales. **If the government doesn't act soon, it's felt, the domestic market will fall off drastically and the current boom in auto production will end.**

ITALY: inspired designs are ballooning export sales

By Gene di Raimondo
American Machinist Milan Bureau

Italian automakers are riding the crest of a boom that has gathered momentum ever since World War II's end. Primary reason is the genius of its designers, who not only have achieved world-wide recognition for design of Italian cars, but have been employed to design bodies for U S, British and other foreign makes.

Of late, production figures have ballooned to the point where Italy is now Europe's fourth-ranking producer (460,000 cars last year, compared with 250,000 in 1954, and 90,000 in 1937).

Biggest Italian auto producer is Fiat of Turin, which accounts for

U S-made presses at Fiat . . .
Twin rows of Clearing (left) and Danly presses in the heavy press shop at Fiat's Mirafiori plant turn out components for 80% of Italy's car output

Self-sufficiency is the rule . . .
. . . among Italian automakers. These are Lectromelt furnaces in Fiat's own steel mill at Turin. Except for tires, batteries and the like, Italian automakers produce virtually everything that goes into their cars

nearly 80% of total Italian capacity, with the remaining 20% divided among Alfa Romeo, Lancia, O M, and Autobianchi.

Italy's motor car industry is concentrated in northern Italy—Turin, Milan (Alfa Romeo), Brescia (O M), and Desio (Autobianchi). Plants specializing in passenger car bodies are mostly in Piedmont, whereas truck body plants are found there and in Lombardy, Emilia and Venetia.

Fiat last year turned out 348,700 cars, trucks and buses. Alfa Romeo, Lancia, O M and Autobianchi combined produced about 60,000. This year, Fiat plans to make more than 1500 vehicles a day, while the smaller manufacturers will increase their output about 15%.

Italian automaking firms are largely self-sufficient, except for tires, batteries, handles and knobs—all of which come from outside sources. How long this self-sufficiency can be maintained in the face of a rapidly growing market is questionable.

Fiat is the most international-minded of Italian makers. It has assembly plants at Heilbronn, Germany; Waterloo, Belgium; and Amsterdam, producing 50,000, 6000 and 4000 cars a year respectively. It has just opened assembly plants in Australia, Yugoslavia and Mexico, has plans for plants in Siam and Egypt. Among the smaller manufacturers, only Alfa Romeo has an overseas assembly setup. It is tied wih Fabrica Nacional dos Motores of Brazil.

Exports are of increasing importance to the Italians, if the industry is to expand, because the domestic market is relatively stationary. Percentage of Italian automotive output shipped abroad has risen from 10% in 1946 to 42%.

Germany is Italy's best car customer, bought 69,281 units last year, followed by the United States (30,759), then Austria, Belgium, Switzerland, Brazil, South Africa and India.

Even the experts find it hard to estimate how big the market for Italian automobiles will be five years from now. Much depends on the income of the average Italian, which has increased 4% a year.

The market has mushroomed in recent years, considering that one out of every 120 Italians owned a car not too long ago, and today one out of every 25 does, and the cars-per-population ratio continues to increase. Today, close to 60% of all production is absorbed by the domestic market.

Nevertheless, future expansion of the Italian automotive industry will depend to a great degree upon how well the export market does. Fiat has just opened a new plant at Turin. It is so designed as to be expanded fast if demand warrants. Alfa Romeo has a new plant north of Milan, especially necessary now that it has an agreement to build Renaults.

Lancia has under way a $50 million modernization and expansion program, is building a new plant at Chivasse in Northern Italy. **With these and other expansions, Italy's automakers feel that they will have upped production capacity at least 30% by 1965.**

Because the Italian auto industry is world renowned for the excellence of its body designs, the Italians are more inclined to favor frequent model changes than most European makers.

Keeping step wtih increased auto production are steel mills, foundries and other supplier industries. For instance, the Cornigliano steel works at Genoa has just increased production to 1.2-million metric tons a year, is building a new plant in Sicily. Fiat, which makes most of its own steel, is enlarging its plants, too.

With exports soaring and development of the domestic market lagging not too far behind, Italian car companies are prepared to invest in new machine tools and automation equipment as a means of increasing production and at the same time holding down labor costs. But this latter factor presents a thorny problem—the replacement of manual labor with automated equipment would aggravate Italy's chronic and critical unemployment situation.

SWEDEN: quality is beginning to make its mark

Little advertised and virtually unheralded, Sweden's automobiles are nonetheless growing in popularity.

Top Swedish producer is Volvo, which last year made 53,360 automobiles and 15,448 trucks for a total sales of $154 million. About half of Volvo's output was sold domestically, and of the remainder the U S took half (15,600 vehicles), other Scandinavian nations 10,000 units, Europe 3300, and other nations 3000.

Mostly foreign-made parts

Unlike the Italians, the Swedes are not self-sufficient, rely on the United States, Germany, Britain, Norway and Denmark for parts.

Sweden has two other producers: Scania Vabis, specialists in diesel engines, and trucks and buses (5400 sold in 1958); and SAAB, an aircraft plant that has come into the auto business since World War II (Last year's output: 14,000 passenger cars for a total value of $20 million—nearly half of them exported to the U S). All three companies are engaged in major expansion programs.

Sweden is afraid of the European Common Market, of which it is not a member, is pegging its hopes on formation of the Outer Seven Free Trade Association, which it hopes will one day merge with Eucom.

Partial view of Volvo Works at Gothenburg, Sweden

Work in position . . .
Cam clamps in angle-plate T-slots hold transfer plate so work hole aligns with machine spindle. This flexible setup holds jig-boring accuracy

Plate is transferred . . .
Hardened center pin in angle plate locates transfer-plate holes to position work in line. Successive work holes are bored by slipping transfer-plate holes over the spindle

Precision boring with transfer plates

By Frank A Cuthbertson, director of production engineering,
Milwaukee Operations, A C Spark Plug Div,
General Motors Corp

Major production economies at A C Spark Plug's Milwaukee plant are being credited to accurate transfer plates that mount on precision boring machines. The plates are applied when close-tolerance holes must be located and bored in small aluminum castings that assemble into aircraft and missile guidance and control instruments. The plates replace expensive jigs, and they make elaborate jig-boring setups unnecessary.

Transfer plates work this way: Castings are located and clamped, one to each transfer plate, at a bench where simple gages make locating easy. Keys, pins, slots, and other methods line up the workpieces on their transfer plates.

Then the plates with work attached are sent to a horizontal-spindle boring machine on which an angle plate has been set up. The angle plate has a precision-ground centering pin located exactly in line with the spindle of the machine. Each transfer plate has holes precision bored to match hole locations in the work. A transfer plate is mounted on the angle plate, quick-clamped, then moved to locate another hole over the centering pin after the first hole has been bored in the work.

Hardened and ground plates

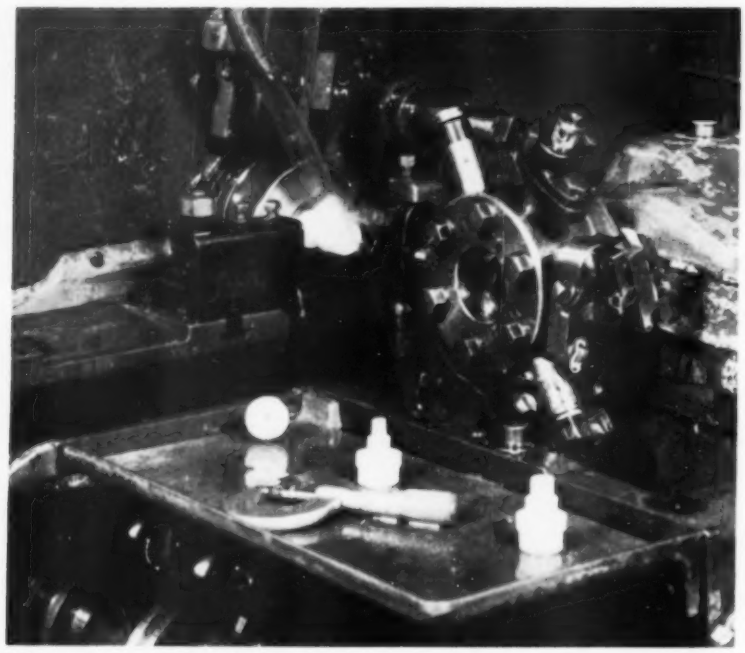
Each transfer plate is SAE 1020 hot-rolled steel that has been carburized, hardened to 60-62 R_c, and ground all over after being machined to size. Holes are jig-ground within $\pm 0.000{,}025$ in. for size and location. A different plate design is required for each different workpiece.

Centering pin and pilot bushing in the angle plate are SAE 5146 heat treated to 60 R_c and ground to the same tolerance as the transfer plates. Pilot bushings are applied when double-end boring is done, and they clear the boring bar as it comes in to cut the back surface of the work.

Flexibility

Transfer plates permit flexible production scheduling because one workpiece can be completely bored in a single machine; work and transfer plate are moved around to center holes over the centering pin; tools are changed in the machine spindle as required.

Production costs are reduced, scrap loss minimized, and uniform product quality developed on orders for several thousand parts. When production orders are larger, it is possible to set up a number of machines, each tooled for a different hole size, to improve on machine-time efficiency. Locating the work in this manner minimizes the skill required by machine operators and reduces lost time at the machine.

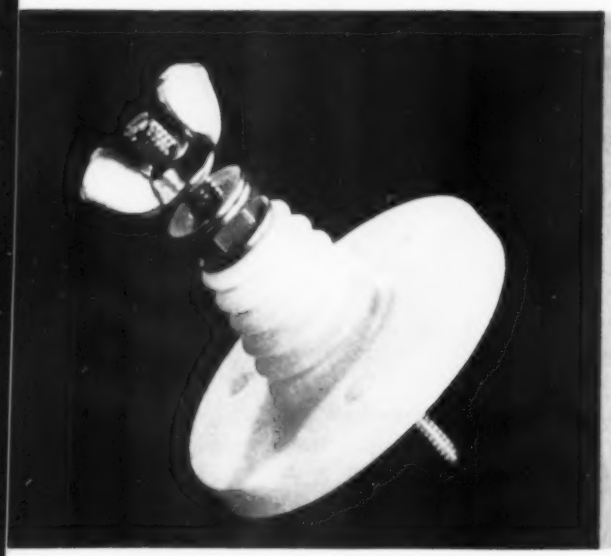


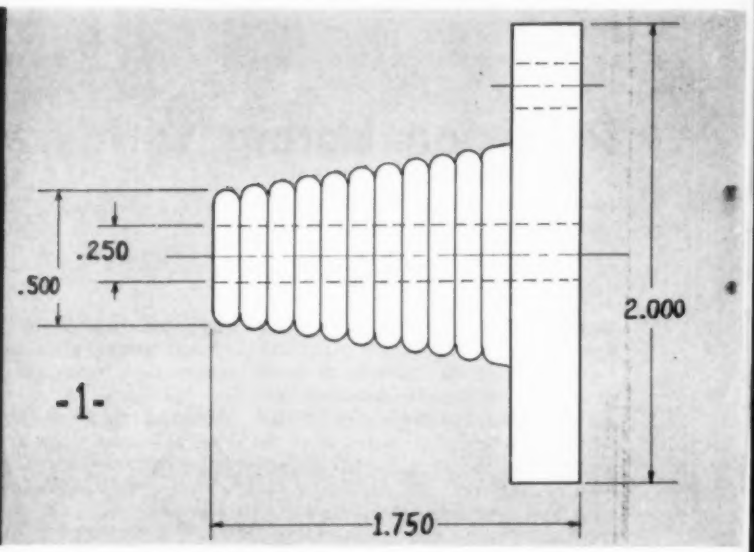
Teflon parts can be machined . . .
on any high-speed metalworking machine—lathes, screw machines, drillpresses—either automatically or manually fed. Cutting oils remove heat from the cutting zone

Machining

What properties do you look for in a material from which you must machine small, close-tolerance parts? Softness, poor thermal conductivity, variable stress relaxation, cold flow? Obviously not. But Teflon, which exhibits all these properties, can be machined to within 0.001 in., sometimes to 0.0005 in. The trick is knowing how these properties influence the cutting operation.

But why machine it at all? Wouldn't be easier to mold these Teflon parts? Perfectly normal questions . . . but Teflon is not a normal material. Tetrafluoroethylene resin (Teflon is DuPont's tradename for its TFE resin) doesn't flow well in the melted state and can be molded only at extremly high temperatures. So when close tolerances must be





Case history No. 1 . . .

Part: *Electronic insulator for submarine service*

Material: *2-in.-dia Teflon rod*

Problem: *Cutting external ribs, facing the mounting surface, and drilling the small-diameter through hole—with all dimensions held within 0.001 in.*

Solution: Because of the heat generated in deep hole drilling and in forming of heavy-cross-section stock, a cutting oil was used (Texaco Cleartex Oil). The external ribbing was formed with a special one-piece forming tool. Three cuts were made: rough, semi-finish and finish, all at 500 sfpm. Without cutting oil for heat removal, cutting speed would have been reduced to half; depth of cut by at least two-thirds.

The small through hole was drilled in several stages, to prevent heat buildup and subsequent deformation. To get the 0.250-in. dia, a drill of approximately 0.254-in. dia was used, thus compensating for the expansion of material in the heavy section while drilling and the subsequent contraction. Drill speeds were stepped down from 0.008 ipr to 0.006 ipr and finally to 0.003 ipr.

After normalizing at room temperature, and while still in the original setup the mounting face was turned at a cutting speed of 500 sfpm. Then the piece was cut off from the bar stock.

Teflon to ±0.0005 in.

held, Teflon parts are machined from rod stock.

In the three case histories presented here you'll see many of the special techniques that have been developed for machining this slippery, waxy material. But, first, let's look at the peculiar properties of Teflon, and see how these properties affect precision machining operations.

Softness

Teflon can readily be indented and "pushed" under load. Therefore, tool pressure during machining should be kept low, slicing the material rather than actually biting into it. Under too high a pressue, Teflon tends to pull away from a drill, resulting in undersize dimensions when the material regains its original form. The reverse (oversize dimensions) is true on external forming and turning operations.

Poor thermal conductivity

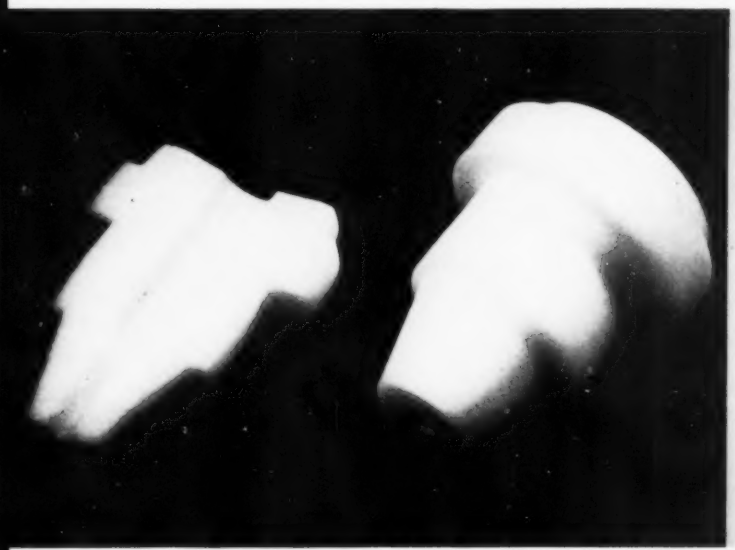
Unless sections of ⅛ in. or less are being worked, Teflon will not absorb and dissipate frictional heat generated during the machining operation. Heat thus generated will be retained in the cutting zone and be radiated back to the tool, causing it to burn and become dull. The dulled tool then compounds the trouble, causing increasingly greater amounts of heat to be generated. Selection and use of the proper cutting oil can minimize this problem.

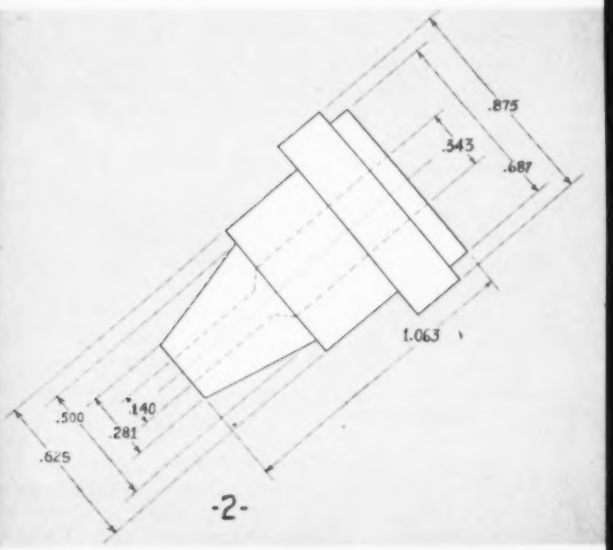
Probably the slipperiest material yet developed, Teflon requires cutting oils, or coolants, not for lubrication but for rapid removal of frictional heat from the cutting zone.

Obviously, tool heating or excessive cutting rates must be avoided if close tolerances are to be maintained. Heating is especially troublesome in the machining of inside diameters where cutting oils cannot be fully effective in removing heat. For example, the frictional heat retained in the wall of a drilled hole may cause lateral surface expansion. This will increase the diameter of the hole and the drill will remove less material, making the final hole undersize or tapered when the material regains its original shape.

Variable stress relaxation

The nature of TFE resin and the method of producing rod, tube and





Case history No. 2 . . .

Part: *Electronic insulator for missile service*

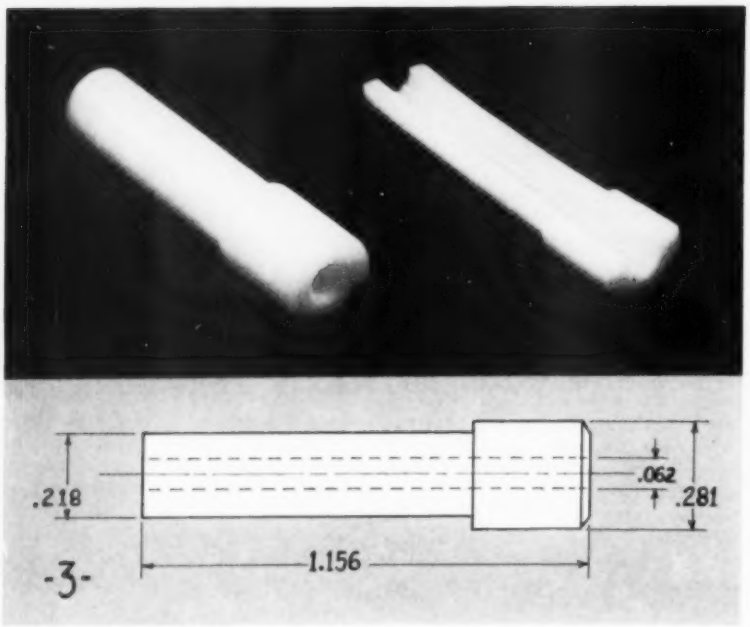
Material: *Teflon rod*

Problem: *Maintain extremely critical diameters and tapers within 0.001 in.*

Solution: Here again, cutting oil is necessary to remove heat rapidly. With the oil, the piece was machined at 600 sfpm; without cutting oil this would have to be reduced to about 200 sfpm, if it could be run at all. The entire piece, with internal and external diameters and tapers, was machined in one operation. Tolerances during machining were held to 0.0005 in. to achieve the final 0.001 in.

External diameters and tapers were formed first, followed by the two inside diameters. Two tools were used for the former, and one for the latter operation. As in all operations on heavy sections, rough, semi-finish and finish cuts were made. The external diameters were roughed at tool feeds of 0.002 ipr; finish cuts were made at a feed of 0.001 ipr. Other turning operations (taper, breaking edges) were performed at feeds of 0.006 ipr.

On initial drilling, a rapid in-and-out action allowed dissipation of heat to the cutting oil. Internal drill feed ranged from 0.008 to 0.009 ipr; spindle speed was 2800 rpm. Counterboring tool feed was between 0.005 and 0.006 ipr, depending upon the mass of stock.



Case history No. 3 . . .

Part: *Shaft bushing and positioner*

Material: *Teflon rod*

Problem: *Extreme ratio of length to hole diameter*

Solution: This type of part is one of the most difficult to machine from Teflon. Again, the long drilling and turning operations make cutting oil a must.

A machinist not too familiar with Teflon might find the stock pushed out of shape by the advancing drill; he might even drill out through the wall. Even if he supported the stock and proceeded slowly, he might still find the hole tapered.

The external diameters were turned first, with the tool feed of 0.005 ipr. Then the 0.0625-in.-dia hole was drilled, again using a drill slightly oversize to compensate for anticipated material expansion and contraction, as well as stress relaxation.

Rough initial drilling was performed with adequate external support, at feed rates of 0.008 to 0.009 ipr. In this rough drilling, the tool was moved in and out at frequent intervals to wash the internal surfaces and remove even the smallest chip. Finish drilling was completed with the same drill at a feed of 0.008 ipr.

sheet stock yield a variably stressed material. Machining tends to relieve these stresses on an uncontrolled basis. Given good Teflon stock with low-level stresses, an operator schooled in the peculiarities of the material can overcome or control such stress relaxation. By keeping his tools sharp and the tool pressure low, and by using the proper cutting oil, the operator can often make the machining operation work in his favor in relieving these stresses. In this way it is possible to achieve the critical dimensions with exceptionally low reject rates.

Cold flow

As opposed to inherent material softness, cold flow takes place when Teflon is under sustained load, as in hold-down, clamping, or chucking. This differs from "wiping" of the surface, which is caused by slight surface melting. During cold flow a permanent volumetric displacement of material occurs. This is reversible through extensive heat treating, provided the critical displacement point is not exceeded.

High-density material

These four major characteristics of TFE resin have been studied carefully, over the past eight years, by Tri-Point Plastics, Inc, of Albertson, NY. This company deals exclusively with TFE resin and has developed special techniques and equipment for its processing.

To eliminate or substantially reduce the effects of material variation on machining results, Tri-Point has designed special extrusion equipment that yields a high-density, low-void, low-stress stock, which the company calls TSI. This has uniform density and low void content from core to surface. (An indication of the soundness of a TFE material is the turning or chip that is produced. It should be a continuous smooth curl, not broken chips. Powdery cutting indicates a degraded material, one with low density, high void content, or incomplete sintering.)

Techniques and tools

The case histories cover many of the special machining techniques that make close-tolerance machining of Teflon possible. Since special techniques often require special tools, Tri-Point maintains its own tooling department. Over the years, high-speed cutting tools, preferably Stellite with very sharp cutting edges, have been found best for machining Teflon.

Forming tools should, in general, have a 15° to 20° top rake for rapid chip removal, and a 10° to 15° front clearance angle to minimize compressive forces which might distort the relatively soft material. Turning tools should have large cutting angles, and drills should have polished flutes to reduce frictional heat and provide for rapid chip removal. All tools, naturally, should permit good cutting oil flow to the cutting zone.

Tool feeds and speeds are given in the case histories. These are typical rates for precision work on any TFE resin material.

An engineer's guide to

Blind Riveting Practices

Extensive data on joint design and joint strengths will be included in the Special Report in American Machinist for September 7.

CIRCLE 219 READER SERVICE CARD ►

Tomorrow this transfer machine will work on a different part

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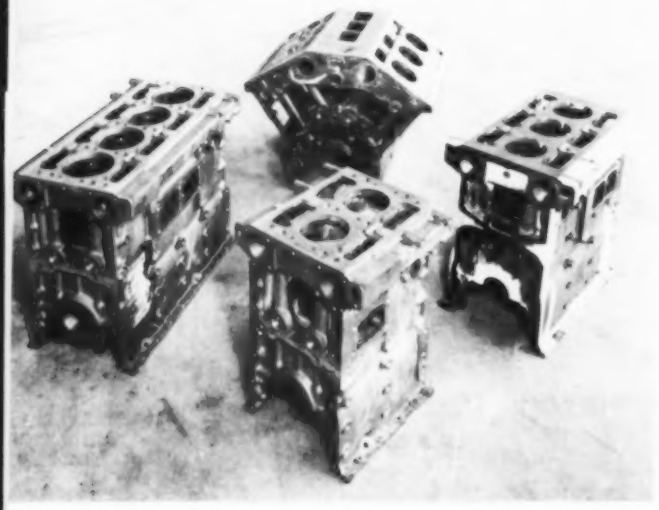
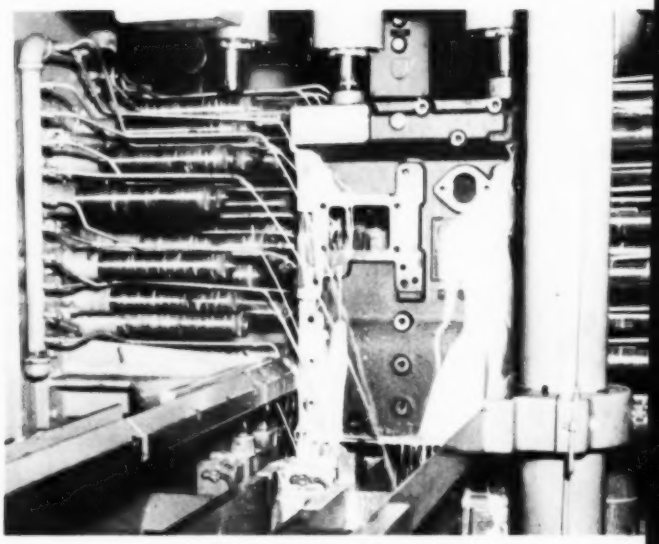
(see other side)

FOUR PARTS OR ONE CAST IRON OR ALUMINUM

It's all the same to these Natco transfer machines





Look at these four diesel engine blocks. Each is a different machining problem, yet one line of three Natco Holeways does the complete job on them all.

Natco designing skill shows in the easy way these machines accept the four different blocks, either cast iron or aluminum. In only 40 working stations these machines can perform 485 operations. Ingenious transfer devices enable all faces of the workpiece to be machined. Versatile building block construction keeps the line ready for conversion when models change.

Natco Holeway No. 1 is capable of performing 173 different operations drilling, rough boring, reaming, chamfering and counterboring.

Holeway No. 2 does 139 similar operations, including end milling of these same engine blocks.

Holeway No. 3 performs 173 tapping operations. These machines work on all the external faces of the blocks, including the angular faces of the V-block.

Product mix problems? Think what a truly flexible Natco like this could do for them! Weigh the value of a Natco which accepts a variety of parts and decides what work to do on them. Even if your production won't justify this ultimate in automatic machining Natco builds drilling, boring, tapping, facing, reaming, chamfering machines in all degrees of automation.

Standard or special, if your machining job is holes, Natco makes the machine to do it better. Let our representative show you. Call him today.

NATCO NATIONAL AUTOMATIC TOOL COMPANY, INC., RICHMOND, IND.

These tags suggest just a few of the many kinds of steel wire we make at our modern wire mills. Some are ordinary types of wire, others are for special purposes. And whether it's low- or high-carbon wire, bright, annealed, galvanized, or bethanized . . . we pay the strictest attention to all of the important details that mean top-quality steel wire.

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BATH *Tap'n Gage* TIMES

A series of technical discussions that will be helpful in getting better results from tapping and gaging operations

Vol. 1 No. 9

Subject: Tap Pitch Diameters for Classes 2, 3, 2B and 3B

The tap pitch diameter (H limit number) necessary to produce a given class of fit is dependent on many factors other than the tap. The recommended limit numbers normally produce the class of thread as listed when used in average materials with reasonable care. If an unsatisfactory gage fit results, a choice of some other limit tap may be necessary.

Unified and American Screw Threads, Coarse and Fine Series — Sizes 0 to 1½".

Size	Threads Per Inch		†Recommended Tap for Class of Thread				Pitch Diameter Limits for Class of Thread				
	NC and UNC	NF and UNF	Class 2	Class 3	Class 2B	Class 3B	Min. All Classes (Basic)	Max. Class 2	Max. Class 3	Max. Class 2B	Max. Class 3B
0	..	80	H 1	H 1	H 2	H 1	.0519	.0536	.0532	.0542	.0536
1	64	..	H 1	H 1	H 2	H 1	.0629	.0648	.0643	.0655	.0648
1	..	72	H 1	H 1	H 2	H 1	.0640	.0658	.0654	.0665	.0659
2	56	..	H 1	H 1	H 2	H 1	.0744	.0764	.0759	.0772	.0765
2	..	64	H 1	H 1	H 2	H 1	.0759	.0778	.0773	.0786	.0779
3	48	..	H 1	H 1	H 2	H 1	.0855	.0877	.0871	.0885	.0877
3	..	56	H 1	H 1	H 2	H 1	.0874	.0894	.0889	.0902	.0895
4	40	..	H 2	H 1	H 2	H 2	.0958	.0982	.0975	.0991	.0982
4	..	48	H 1	H 1	H 2	H 1	.0985	.1007	.1001	.1016	.1008
5	40	..	H 2	H 1	H 2	H 2	.1088	.1112	.1105	.1121	.1113
5	..	44	H 1	H 1	H 2	H 1	.1102	.1125	.1118	.1134	.1126
6	32	..	H 2	H 1	H 3	H 2	.1177	.1204	.1196	.1214	.1204
6	..	40	H 2	H 1	H 2	H 2	.1218	.1242	.1235	.1252	.1243
8	32	..	H 2	H 1	H 3	H 2	.1437	.1464	.1456	.1475	.1465
8	..	36	H 2	H 1	H 2	H 2	.1460	.1485	.1478	.1496	.1487
10	24	..	H 3	H 1	H 3	H 3	.1629	.1662	.1653	.1672	.1661
10	..	32	H 2	H 1	H 3	H 2	.1697	.1724	.1716	.1736	.1726
12	24	..	H 3	H 1	H 3	H 3	.1889	.1922	.1913	.1933	.1922
12	..	28	H 3	H 1	H 3	H 3	.1928	.1959	.1950	.1970	.1959
¼	20	..	H 3	H 2	H 5	H 3	.2175	.2211	.2201	.2223	.2211
¼	..	28	H 3	H 1	H 4	H 3	.2268	.2299	.2290	.2311	.2300
5/16	18	..	H 3	H 2	H 5	H 3	.2764	.2805	.2794	.2817	.2803
5/16	..	24	H 3	H 1	H 4	H 3	.2854	.2887	.2878	.2902	.2890
3/8	16	..	H 3	H 2	H 5	H 3	.3344	.3389	.3376	.3401	.3387
3/8	..	24	H 3	H 1	H 4	H 3	.3479	.3512	.3503	.3528	.3516
7/16	14	..	H 5	H 3	H 5	H 3	.3911	.3960	.3947	.3972	.3957
7/16	..	20	H 3	H 1	H 5	H 3	.4050	.4086	.4076	.4104	.4091
½	13	..	H 5	H 3	H 5	H 3	.4500	.4552	.4537	.4565	.4548
½	..	20	H 3	H 1	H 5	H 3	.4675	.4711	.4701	.4731	.4717
9/16	12	..	H 5	H 3	H 5	H 3	.5084	.5140	.5124	.5152	.5135
9/16	..	18	H 3	H 2	H 5	H 3	.5264	.5305	.5294	.5323	.5308
5/8	11	..	H 5	H 3	H 5	H 3	.5660	.5719	.5702	.5732	.5714
5/8	..	18	H 3	H 2	H 5	H 3	.5889	.5930	.5919	.5949	.5934
¾	10	..	H 5	H 3	H 5	H 5	.6850	.6914	.6895	.6927	.6907
¾	..	16	H 3	H 2	H 5	H 3	.7094	.7139	.7126	.7159	.7143
⅞	9	..	H 6	H 4	H 6	H 4	.8028	.8098	.8077	.8110	.8089
⅞	..	14	H 4	H 2	H 6	H 4	.8286	.8345	.8322	.8356	.8339
1	8	..	H 6	H 4	H 6	H 4	.9188	.9264	.9242	.9276	.9254
1	..	12	H 4	H 2	H 6	H 4	.9459	.9515	.9490	.9525	.9505
1	11½N8	..	H 4	H 2	H 6	H 4	.9536	.9585	.9572	.9609	.9590
1⅛	7	..	H 4	H 4	H 4	H 4	1.0322	1.0407	1.0381	1.0416	1.0393
1⅛	..	12	H 4	H 4	H 4	H 4	1.0709	1.0765	1.0749	1.0787	1.0768
1¼	7	..	H 4	H 4	H 4	H 4	1.1572	1.1657	1.1631	1.1668	1.1644
1¼	..	12	H 4	H 4	H 4	H 4	1.1959	1.2015	1.1999	1.2039	1.2019
1⅜	6	..	H 4	H 4	H 4	H 4	1.2667	1.2758	1.2738	1.2771	1.2745
1⅜	..	12	H 4	H 4	H 4	H 4	1.3209	1.3265	1.3249	1.3291	1.3270
1½	6	..	H 4	H 4	H 4	H 4	1.3917	1.4018	1.3988	1.4022	1.3996
1½	..	12	H 4	H 4	H 4	H 4	1.4459	1.4515	1.4499	1.4542	1.4522

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Machining Titanium – III

By Bennet V. Whiteson, metallurgical engineer, Titanium Metals Corp of America, New York

Chipping is the predominant mode of tool failure in titanium milling. As the milling-cutter tooth emerges from the work, a small piece of titanium is usually welded to the cutting edge. Then, as the tooth re-enters the work, the chip breaks off, taking part of the cutting tool with it.

To reduce this type of failure, climb milling should be used where possible, except when the workpiece has hard scale.

High-speed steel tools have the highest toughness and are more resistant to failure by chipping than are carbide tools and cast alloys.

Some fabricators view the tough cast-alloy tools as providing a workable compromise in selection of tool material. Cast alloys yield about a 25% increase in cutting rates over high-speed steels, and provide more resistance to the chipping action that causes failure in carbide tools. They operate at cutting rates 30% lower.

Regardless of the tool used, the smallest diameter cutters with the largest number of teeth should be used to minimize deflection and chatter. Further, cutters should not be allowed to dwell in the work, and should never be returned across the workpiece without being retracted from it.

Relief angles are critical in milling of titanium. For short runs, it is common practice to modify standard high-speed steel milling cutters by increasing relief angles and making sure that faces of the teeth are smooth.

Increasing the relief 30 to 50% over that used on standard cutters reduces pressure, deflection, the tendency to load, and yields good tool life if failure due to chipping is not excessive. If excessive chipping again occurs, relief angles should be reduced.

Rake angles are not critical. In general rake angles are positive, while many fabricators prefer 0° rake angles to overcome a tendency to dig in and chip. Negative rake angles are generally employed where carbide tools are used for high-speed operations on the softer titanium alloys. Use of negative rake angles requires greater power and rigidity in the machine and workpiece than zero or positive rake angles.

Peripheral cutting edge angle (corner angle) in conjunction with a small nose radius will provide a thin, wide chip that distributes the cutting load over a wider area thereby increasing tool life. Larger nose radii also have the same effect.

Chamfer and nose radius provide the same effect as the corner angle; i.e. a wide chamfered area or large nose radius forms a thinner chip and distributes cutting over a wider portion of the tool face.

Water-base coolants incorporating rust inhibitors or water-soluble oils are best for milling operations, although low-viscosity, sulfo-chlorinated oil may be used when cutting speeds are low.

Recommended Tool Materials, Angles and Machine Settings for Milling Titanium

Tool Materials

Type of Operation	1st Choice	2nd Choice	3rd Choice
Low production	T-5 HSS	Cast alloy	C-1 or C-2 carbide
Form cutters	T-5 HSS	Cast alloy	C-1 or C-2 carbide
Face milling	C-1 or C-2 carbide or cast alloy		HSS
Slab milling	C-1 or C-2 carbide or cast alloy		HSS

Tool Geometry

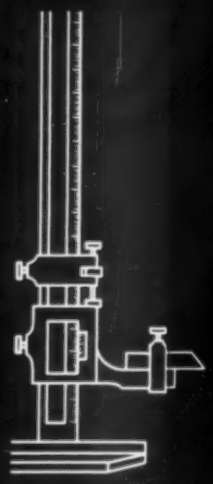
	Tool Material		
Angle	Carbide	Cast Alloy	HSS
Radial rake,	0 to −10	0	0
Axial rake,	0 to −10	0	0
FCEA, (a)	6	6	6
PCEA, (b)	60	30	30
Face relief, (c)	12	12	12
Peripheral relief, (c)	12	12	12
Chamfer,	0 to 45	0 to 45	0 to 45
Nose radius, in.	0.040 to 0.125	0.040 to 0.125	0.040 to 0.125

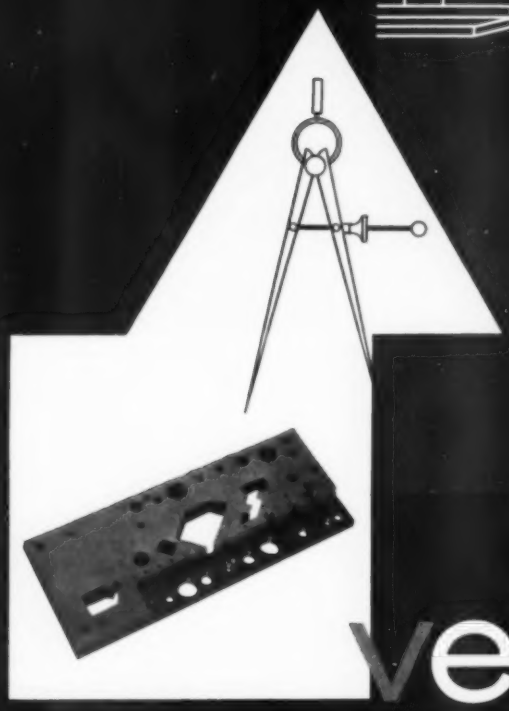
(a) Face cutting edge angle or end cutting edge angle
(b) Peripheral cutting edge angle or corner angle
(c) Use smaller relief angles if excessive chipping occurs

Machine Setting

	Titanium Grades		
	Commercially Pure	Annealed Alloys	Heat-Treated Alloys
Carbide Tools			
Speed, sfpm	160-190	80-120	55-95
Feed, ipt	0.004-0.008	0.004-0.008	0.004-0.008
Depth of cut, in.			
Face mill	←	Up to 0.050 (a)	→
Slab mill	←	Up to 0.100 (a)	→
Cast-Alloy Tools			
Speed, sfpm	120-140	60-100	45-90
Feed, ipt	0.004-0.008	0.004-0.008	0.004-0.008
Depth of cut, in.			
Face mill	←	Up to 0.050	→
Slab mill	←	Up to 0.100	→
High-Speed-Steel Tools			
Speed, sfpm	80-110	40-70	25-60
Feed, ipt	0.003-0.006	0.003-0.006	0.003-0.006
Depth of cut, in.			
Face mill	←	Up to 0.050	→
Slab mill	←	Up to 0.100	→

(a) For scale or forging skin removal, depth of cut must be below skin by 0.020 in. greater than nose radius





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American Machinist

REFERENCE BOOK SHEET

How well do you know stainless steel? – I

A stainless-steel metallurgist answers some of the frequently asked questions about stainless steel

By Roland J Berkol,
Technical Information Service,
Stainless and Strip Division,
Jones & Laughlin Steel Corporation, Detroit

Q. What is stainless steel?
A. Stainless steels comprise 40 or more ferrous alloys containing a minimum of 11.5% chromium. Many alloys contain more than 11.5% chromium however, and the austenitic group, popularly known as "18-8", contains approximately 8% nickel.

Q. What makes stainless stainless?
A. Chromium gives stainless its corrosion-resistant properties. Current theory holds that a thin, transparent, and very tough film forms on the surface. It is inert or passive and does not react with many corrosive materials that will attack mild steel and other metals.

Q. What are the significant differences between stainless steels and mild steels?
A. The principal difference, of course, is corrosion resistance. Mechanical properties of stainless are also superior to those of ordinary steels. Ultimate strength of annealed 300 types varies from 80,000—100,000 psi whereas mild steel runs around 55,000—60,000 psi.

In a full hard condition, Type 301 exceeds 200,000 psi. Creep strength of many alloys of stainless is much greater than for mild steel. Stainless steels also have a much lower thermal conductivity (1/3 that of mild steel for the 300 series, ½ for the 400's). The 300 series has a higher coefficient of thermal expansion. The electrical resistance of stainless steel is as much as eight times greater than that of mild steel.

Q. What is martensitic stainless steel?
A. Members of this family in the 400 series can be hardened and tempered by heat-treatment to obtain a wide range of physical properties. Their corrosion resistance is somewhat lower than the 300's.

Q. What is austenitic stainless steel?
A. Austenitic stainless steels are one of three families of stainless. They are also known as the 300 series. The basic alloy in this series—Type 302—is the so-called "18-8" stainless steel. The 300 series has an austenitic microstructure at room temperature, cannot be hardened by heat-treatment but can be hardened by cold-working. The 300 series is more corrosion resistant than the 400 series.

Q. What is ferritic stainless steel?
A. This is another group in the 400 series; these alloys cannot be hardened by heat-treatment or cold-working. Type 430 is widely used in automobiles for body and window moldings.

Q. What about the 200 series?
A. The 200 series is austenitic. Manganese replaces a large part of the nickel. These alloys have characteristics similar to those of the 300 series.

Q. Is the 500 series of alloys actually stainless?
A. No, although this group is sometimes included with stainless steels. It is not truly stainless because it contains less than 11.5% chromium. The 500-alloys are used primarily for heat resistance.

Q. What do the numbers assigned to the various types of stainless steel mean?
A. These are standard type numbers published by the American Iron and Steel Institute. A specific type number shipped from one mill should have the same general analysis as the same type shipped from another mill. For example, Type 302, the basic 18-8 type, from a producer should contain 17-19% chromium, 8-10% nickel; not over 0.20% carbon, 2% manganese, 1% silicon, regardless of the producer. Some sulphur and phosphorus are present.

Q. Are all stainless steels non-magnetic?
A. No, martensitic and ferritic types (400 series) are magnetic. Austenitic 200 and 300 types are not magnetic in an annealed condition but may become slightly magnetic when cold worked.

Q. People generally think of stainless with a brightly polished "mirror" finish. Is stainless always used highly polished?
A. No. Many applications require only a low or dull finish. The most widely used finish is No. 4 with a satiny quality commonly seen on store fronts and building exteriors. There are eight standard finishes available from the mills plus many special finishes, largely used for decorative purposes.

Q. Is stainless made only in sheet or strip form?
A. No. Stainless can be purchased in all standard forms such as wire, bar, plate and pipe in a wide range of sizes.

Q. Can stainless be machined easily?
A. Some types of stainless are readily machinable.

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How well do you know stainless steel?—II

For high production one of the stainless types specifically formulated for machining should be used. For example, the high sulphur content of type 303 aids machinability. Type 303Se contains selenium for easier machining when fine feeds are involved. Free-machining alloys are available in each stainless group.

Q. What feeds and speeds should be used for the free-machining types?
A. The latest practice in high-production machining makes use of feeds and speeds approaching those of mild steel.

Q. Can stainless be welded?
A. With a few exceptions, all stainless alloys can be welded by any of the common methods. In general, the 300 series are more easily welded. Some of the 400 series alloys may require pre-heating and post-annealing.

Q. Are there special welding grades, such as there are for machining?
A. Yes. They are designed for welded assemblies which will be subjected to corrosive conditions. In the 300 series there are two special sub-groups formulated for welding. The stabilized types (321, 347, 348) contain titanium, tantalum and columbium which prevent the formation of troublesome chromium carbides. In the low carbon types (304L, 316L, 309S, 310S), the formation of harmful carbides is reduced because the carbon itself is decreased, as is also true for types 321, 347 and 348.

Q. Why are chromium carbides harmful?
A. Chromium carbides reduce corrosion resistance. In the unstabilized austenitic alloys, chromium carbides precipitate during slow cooling in the 800-1600F range, as in welding. As a result there is less chromium to resist corrosion because it has combined with carbon.

Q. Can carbon precipitation be corrected?
A. Full solution annealing and quick cooling, through the sensitizing range (800-1600F), will put carbon and chromium back into solid solution.

Q. What other special formulations are there?
A. In the martensitic group (400 series) there are four types (420, 440A, B, C) with increasing amounts of carbon (up to 1.20%) to achieve high hardness. In the ferritic group Type 446 has a high chromium content (23-27%) to resist corrosion at high temperatures. The austenitic group (300 series) also has types formulated for high-temperature service and severely corrosive conditions as well as for structural uses where maximum strength is needed.

Q. In other words, when you have a special problem should you look for a specific alloy to solve it?
A. Yes. In applications involving heavy welding, production machining, high temperatures or other special conditions, specific formulations should be considered.

Q. With so many special types, are the original basic types obsolete?
A. Absolutely not. The basic types (302-austenitic, 410-martensitic, 430-ferritic) account for 50% of all stainless used today. A prospective user should consider the basic types first in selecting a stainless steel because of lower price and ready availability.

Q. Are new alloys being developed?
A. New alloying agents are being researched constantly. For example, stainless containing boron was recently developed for atomic-energy work.

Q. Speaking of new types, what about the precipitation-hardening grades?
A. The PH types are widely used in aircraft and missile applications because of their high tensile and creep strengths at elevated temperatures, plus corrosion resistance. These properties are developed by simple heat-treatment.

Q. Can stainless be used in all corrosive applications?
A. No. Some materials are too corrosive for even the most resistant types, such as 316 and 317. Chlorine and other halogens will attack stainless after long exposure.

Q. Why is stainless used so widely in milk processing?
A. In food and beverage processing plants stainless offers two advantages: cleanliness and freedom from product contamination. Cleaning agents which are often corrosive, have no effect on stainless; in turn, stainless does not affect the taste of products, such as milk, which sometimes occurs when ordinary steels are used. Stainless is often used to combat product contamination and corrosion resistance in textile, paper and chemical plants.

Q. Is the use of stainless increasing?
A. Definitely. By 1970 or before, annual shipments are expected to exceed one million tons compared with approximately 500,000 tons shipped in 1958. Autos and aircraft are our biggest markets today and we expect the application of stainless to expand rapidly in these two industries as well as in chemical processing, atomic energy construction and other fields.

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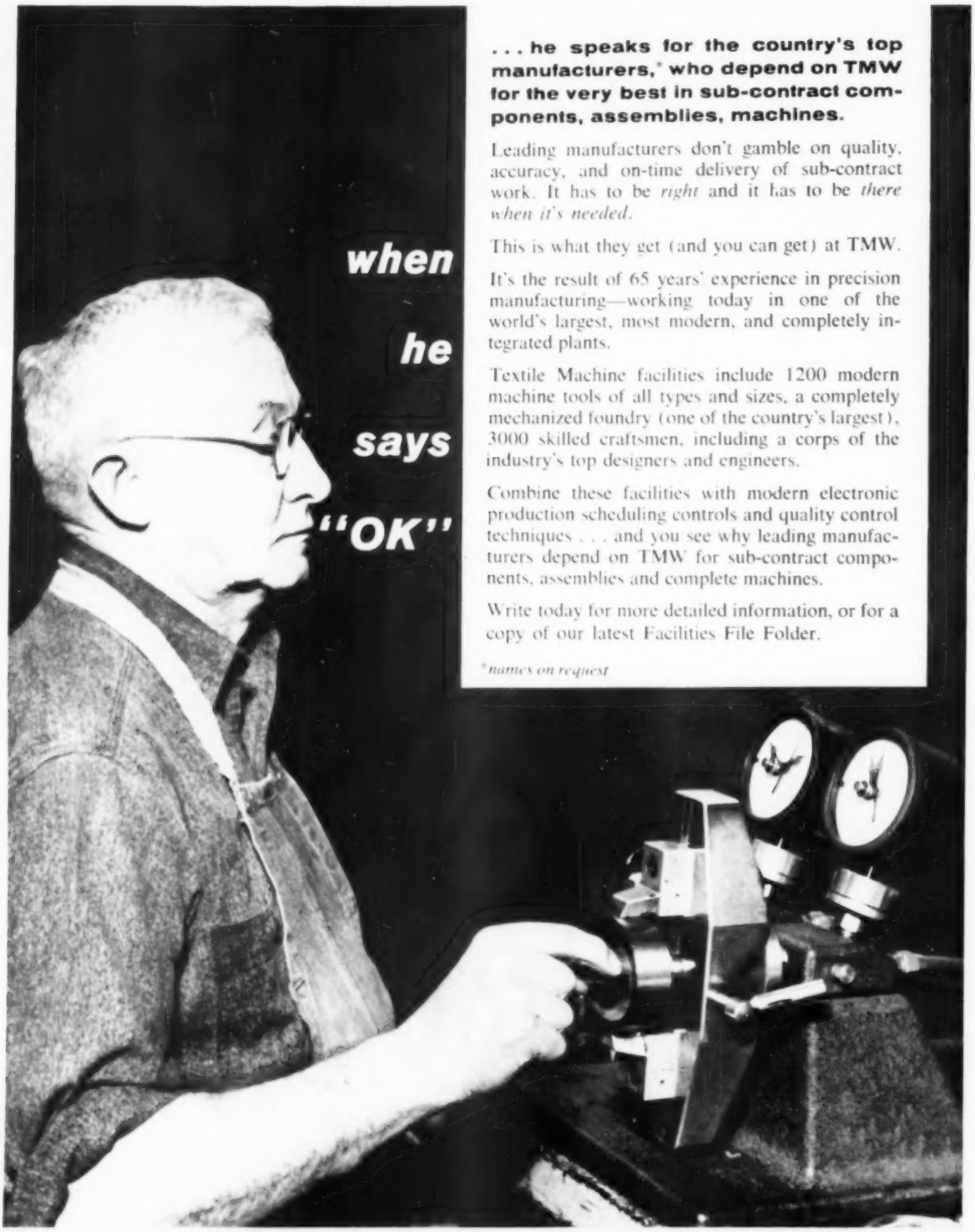

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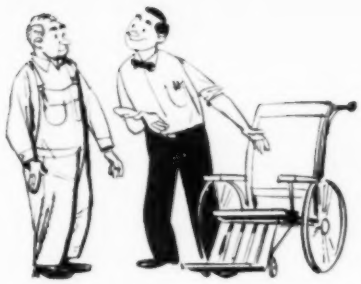


Accident Prone?

SOME RISK may be required for workers to be highly productive, according to a professor at Ohio State University. This startling idea from Dr Thomas Rockwell is based on hours spent concealed on a catwalk studying the habits of assembly-line workers. The average worker on the line was violating some safe work practice 17% of the time.

Individuals varied from 5 to 30% of the time on this scale and the man who had a 30% unsafe rating was the one the foreman considered most productive. This worker had a record of 95 first-aid accidents in three years. The safest worker observed was rated the least productive.

Nothing in Dr Rockwell's studies really means that violation of safe practices should be encouraged. Those 95 first-aid accidents cost a lot and many of them might have been serious lost-time accidents. It does complicate the job of the safety engineer.

For Sale Cheap

The 200-ton atom smasher which Enrico Fermi put into use at the University of Chicago in 1950 is for sale. After just a shade less than ten years it is totally obsolete.

Machine Tools Expensive?

INVESTMENT in today's highly sophisticated machine tools can be sizable. But this wasn't always the case. In the nineteenth century, basic machine tools were not at all expensive. Our authority is a recently published book, *Risk and Technological Innovation*, by Michigan State University Professor W Paul Strassman:

"In the 1830's a fourteen-foot double-engine lathe cost $350 and was the most expensive machine tool coming into common use in large machine shops. By the 1850's a plain milling machine was the typical machine tool used in interchangeable manufacturing, and it sold for about $300. What was then perhaps the most complicated machine tool known, the universal milling machine, cost about $850. Around 1880 the value of machinery, excluding belts and shafting, per worker in a plant manufacturing interchangeable mechanisms was between $300 and $350. The most accurate machine tool known at this time, the automatic pinion cutter of the Hampden Watch Company, cost $4000. In the 1890's, flat-turret lathes sold for about $1100; the first high-precision Norton grinding machine was designed to sell for $2500; and the cost of building the first multiple-spindle automatic lathes was about $500 each."

But would you trade?

Dry Paint

LATEST WONDER PAINT seems to be an epoxy resin suspended in air. The metal object to be painted is heated and as the paint particles come in contact they melt and stick. Baking smooths the coat and gives it a high gloss. Thicknesses of 1 to 20 coats of paint can be given by regulating the heat of the work. Shell Chemical has developed the paint using a process invented in Germany and licensed by Polymer Process Industries in Reading. Although the paint is aimed at hard-to-paint metal objects, the lure of air as a solvent may be strong enough to attract other uses.

MEMOS

by BESS RITTER

The little treadmill contrivance that is frequently placed in a squirrel cage to keep the captive animal active, was originally designed for the human prisoner. The year was 1820, and some means was needed to keep the inmates of one prison usefully employed. Consequently, sombody in authority conceived the idea of a large vertical wheel, complete with a series of horizontal treads, on which the prisoners could exercise themselves by monotonously "climbing" the tread-steps.

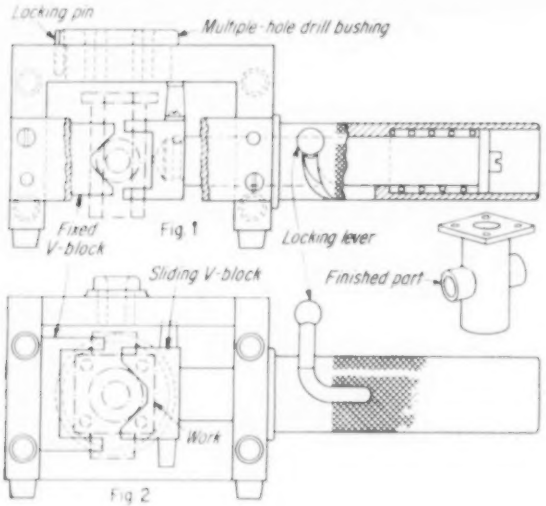
The name of this mechanic is lost to history, but he certainly was ingenious in his own way, because he attached an axle to the wheel, which was used, in its turn, to operate a mill. Hence, the word "treadmill," which is certainly descriptive.

Although the word "velocipede" is commonplace, few people today are familiar with the machine that it originally referred to. This was a "bicycle" that wasn't a bicycle, because it had no pedals, it had no chains, and it had no sprockets. Yet its rider could attain a speed of as much as five miles an hour, by simply straddling its saddle, holding on to its handles, and pushing himself along with his two feet. It was patented in England in 1818, and the name "velocipede" was very well chosen, because "velox" means "swift" and "pes" means "foot."

Today, of course, the word is more or less synonymous with a child's pedaled tricycle, however, throughout the 19th century, when all kinds of wheeled contrivances hit the road, any machine that bore the least resemblance to the original model was known as a "velocipede" as well, regardless of to whether it did or din't have pedals, and whether it had two wheels or more.

Practical Ideas...

Handle of Drill Fixture Houses Clamping Device



A fixture was needed to hold a workpiece into which two holes had to be drilled crosswise. Four smaller holes, encircling the largest of the other two, were, at the same time, to be drilled in a square flange at one end.

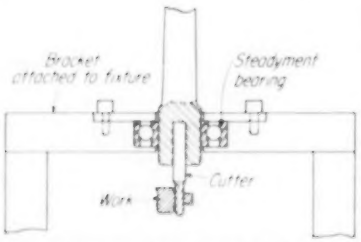
Because of the quantities involved, a convenient, fast working, and self-contained fixture was desired. The illustrated tool, which employs two open V-blocks facing each other at 90°, has wholly filled all requirements.

The clamping device is contained in a knurled handle. It consists of a spring loaded (normally open) plunger which is operated by a lever through a helical slot in the handle. One of the V-blocks is affixed to the back wall of the fixture while the other (sliding block) is guided by a slot milled inside the fixture. The sliding block and the plunger are joined with a pin which seats in a radial groove on the plunger to permit its rotating in the block.

Two drill bushings are used in the fixture, both shop made. The one at the top of the fixture in Fig. 1 is a multiple-hole bushing containing the large central hole and four flange holes. This bushing is prevented from shifting by a short dowel pin inserted in its rim. At 90°, and on the same centerline, a plain shoulder bushing is mounted in a recessed bar as shown in Fig. 2. Four legs are mounted on each of the two base sides and ground parallel with the axis of the fixture.

In loading the fixture, the smaller-diameter extensions of the part are nested in the stationary V-block. This assures alignment of the smallest through hole. Upon closing the sliding V-block, by rotating the locking lever a quarter turn, the larger diameter and flange are lined up and the part is ready for drilling.

Hjalmar Dahl, Upplands Vasby, Sweden



Steadyment Bearing Aids Drillpress-Milling Operation

Because of a tie-up in our milling machine department, we had to resort to a drillpress in an effort to finish a job on time. Fortunately, the operation was a simple one consisting of cutting an elongated hole in a production run of brass forgings.

We constructed a lever-operated fixture to clamp onto the drillpress table for holding and feeding the work. However, the fact that the end mill was by necessity extended, coupled with some wear in the drillpress spindle, created a chatter problem.

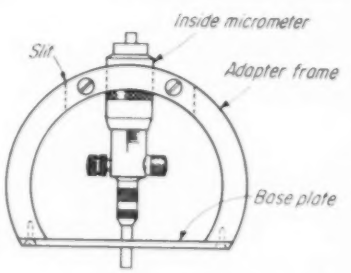
This difficulty was quickly overcome with a steadyment bearing mounted in a bridging frame and properly positioned on the stationary part of the fixture. We chose a sealed ball bearing with an ID large enough to accept the end-mill holder in a sliding fit.

John D Forber, Wallaceburg, Ont, Canada

A New Application For an Inside Micrometer

This adapter, which I have made for my inside micrometer, has saved me the cost of a depth mike. As an added advantage, I am able to measure cavities and steps far beyond the capacity of a standard depth mike because of the number of rods provided with the inside micrometer set.

The adapter is made by first machining a ring from steel plate thick enough to receive a hole for the mike thimble. After a section has been cut away, the hole is bored and the two butts are faced off in the same setting so the mike, when inserted, will be perpendicular with the base. A slit is then cut through the center and on either side of the hole for flexibility when two screws are tightened to clamp the mike in place.

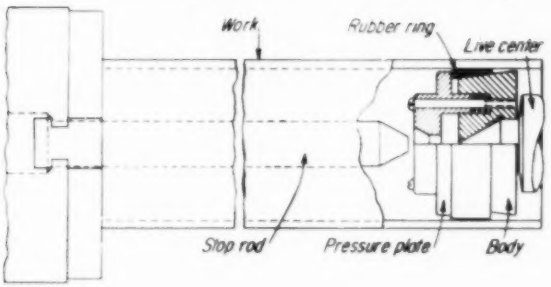


Next a base plate, which is to be screwed to the ring butts, is made. The clearance hole for the rod should be large enough to pass the ½-in. spacer piece at the angle required to insert the mike in the adapter. After the base-mounting holes have been drilled and countersunk, the plate is hardened and ground flat.

To adjust the mike in the adapter, simply zero out the mike and rest the base on a flat surface. The two clamping screws are loosened to allow the shortest measuring rod contact with the surface on which the base is resting. The screws are then retightened and the mike is ready to accept any length rod required.

Paul M Laborn, Jr, Waco, Texas

Expanding Live-Center Adapter Supports Cylindrical Work



Our job was to fabricate a quantity of 24-in-long cylinders with 3½-in. bores. We used seamless steel tubing which we were able to hone to the critical bore dimension. This simplified our work considerably because, as the wall thickness was only 3/16 in., chucking of any kind would have been difficult. But when a fine thread had to be cut in the bore at one end, things became a bit complicated.

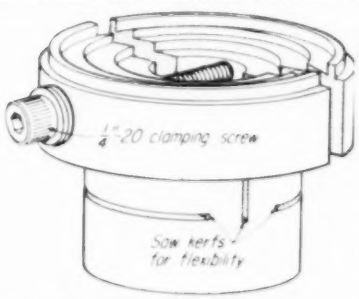
To use an expanding mandrel, we decided, would be too clumsy to manipulate. The use of a steadyrest was out because the OD wasn't concentric enough with the bore and, as we were working within close limits, spot turning for a steadyrest was impossible. Instead, an effective solution was found in an expanding adapter fitted to the live center and activated by a rod seated in the lathe spindle.

As shown in the sketch, the expanding unit comprises three main parts: A body, a pressure plate, and a rubber ring. The body is bored with an included 60° angle to fit the point of the live center. Its OD is machined at 7° taper to match the ID of the rubber ring. The pressure plate has a ring machined on its back face which engages a ring groove in the body where four springs are situated and retained by screws. On the front face of the plate, a concentric hole is partially bored at a 60° included angle to provide a seat for the stop rod.

A shank with a taper to match the bore in the spindle is machined on one end of the rod. The other end is finished in a truncated-60° point after the proper rod length has been determined.

Chucking distortion of the work is prevented by the use of a split ring which is slipped over the jaws of a three-jaw chuck. Thus the work is mounted over the split ring, the expanding center enters the open end and expands against the stop rod, after which the chuck is tightened. A specially-ground toolbit reaches inside the tube to cut the thread.

Y Shmueli, Tivon, Israel



Dual-Purpose Chuck Holds Work Internally or Externally

You don't necessarily have to have a bad lathe chuck to make good use of this tool. But, if a chuck is worn, or for some other reason runs out, this pot chuck will correct that condition.

The primary purpose of a pot chuck is to simplify work holding on small production runs, and then, usually for second operations. Most of them, however, are limited to either gripping the OD or the ID of the work. This chuck can do both by simply switching a clamping screw, to grip the OD of the work, for a jacking screw to make the chuck expand inside the work.

As the drawing indicates, the face of the chuck is counter-faced with several diameters to accept workpieces of as many outside dimensions. The chuck's periphery is also machined to definite dimensions for internally holding the work.

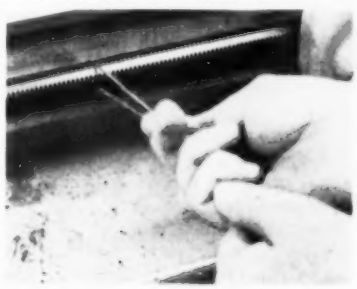
Generally, the construction of this chuck is the same as other pot and expanding chucks. After the shank has been machined and gripped in the lathe chuck, slightly undersize recesses are machined on its face and the OD is left oversize to allow for final machining once the slits have been cut.

Where this chuck differs from others is that the clearance hole for the clamping screw is tapped and used for a jacking screw to expand the chuck. A ¼ in.—20 thread is cut in an appropriately drilled hole through one half of the chuck, while the clearance hole is tapped ½ in.—13.

Norman Fried, Los Angeles, Calif

Cord Cleans Leadscrew

Accumulated deposits of dirt and chips on leadscrews will prematurely wear it and the split nut out if allowed to remain. Such deposits may also cause serious trouble during thread chasing. If chips prevent the split nut from properly closing on the



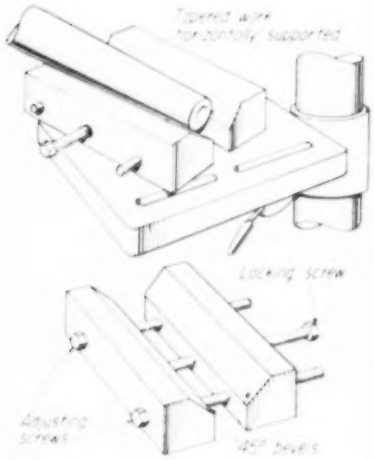
screw, a nearly finished thread can be ruined with one pass.

To eliminate these hazards, it is necessary to occasionally give the screw thread a thorough cleaning. Mere brushing the screw with a solvent is a partial prevention, but not good enough. I've found that the best method is to follow the brushing with a piece of heavy cord looped over the screw while it's rotating.

Pulled tightly in the thread through the screw's entire length, the cord will dislodge even the hardest dirt deposits. In stubborn cases, it is sometimes helpful to use the cord with a whipsawing action to prevent the dirt from piling up in one position on the cord. After this treatment, it is advisable to flush the screw with clean kerosene.

H J Gerber, Stillwater, Okla

Practical Ideas...



Adjustable V-Block Handles Large and Small Work

This V-block will take the place of many others designed to support cylindrical work in a miller or drill-press. It will also perform a function no standard V-block can; that of holding a tapered piece to maintain its center line horizontally.

The fact that this V-block is adjustable, making it possible to cradle relatively large-diameter work with equal stability as it takes quite small pieces, will prove to be a time saver. Instead of hunting around for the right size block, a few seconds spent in adjusting the screws will provide the capacity desired.

When it becomes necessary to drill a hole diametrically through the axis of a tapered part, the jaws are adjusted to present a wider opening where the heavier end of the taper rests. With the aid of a bevel protractor or indicator, these adjustments can be made to locate the axis of a taper perfectly horizontal. After the jaws have been adjusted, whether for parallel or taper support, the center screw is tightened to lock them as set.

A pair of these blocks have been in constant use in our shop for some time. With them, we support long cylindrical work on the milling machine and planer as well as on the surface plate for inspection and layout work. When carefully made, these blocks can come close to the accuracy of solid blocks if identical-parallel spacers are used at each end instead of the locking screw.

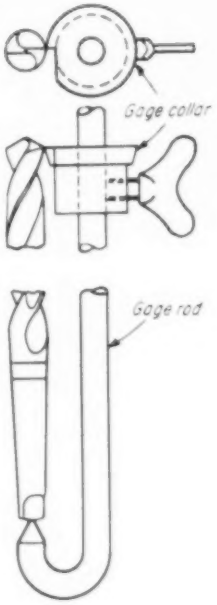
H Josephs, Gardenville, Penna

Drill Gage Shows Flute Length

No great talent is necessary to sharpen a drill accurately when a drill-grinding attachment is used. Skill is manifest when you can produce a perfect drill point 'free hand' without gages or other aids.

Not being so gifted, I devised the simple gage shown which helps me maintain identical flute lengths, leaving only the point angle for me to master. This I have managed to do without too much practice and as a result, when flute lengths and point angles are correct, the drills cut as well as if they had been sharpened in a drill grinder.

All that has to be done, after both cutting edges have been given preliminary grindings, is to check the



flute lengths against each other. You do this by placing the shank's center hole on the gage point and adjust the gage collar to the height of one flute. The drill is then rotated a half turn to check the second flute. If they are identical you're safe, if not, the longer is touched up until it matches the shorter. But, in doing so, be careful that you don't take too much; just give it a touch and try again.

I have also found this gage valuable in checking reamer flutes which I sometimes sharpen free hand. A truer cutting reamer is the result.

Clifford Shipe, Harvey, Ill

Hjalmar Dahl
Upplands Vasby, Sweden

WON

$25 **In addition to regular payment for his idea:**

ROLLER-FORMING DIE

in the June 15, 1959 issue

An extra $25 will be paid for the best Practical Idea in each issue of *American Machinist*. Selection of the winner is made by a group of our readers.

PAYMENT—$25 in addition to regular rates for the items published to be paid as soon as reader votes are received—usually three to four weeks after the date of issue. The winner will also be announced in these pages as soon thereafter as practicable.

JUDGES—A group of 200 *American Machinist* readers is asked to select preferred articles in each issue. The group is a true cross-section of all readers, and changes entirely each time. Their votes, in addition to guiding the editors, select the best Practical Idea. If at any time their votes result in a tie, $25 will be paid to each co-winner. Decision of the readers will be final in each case.

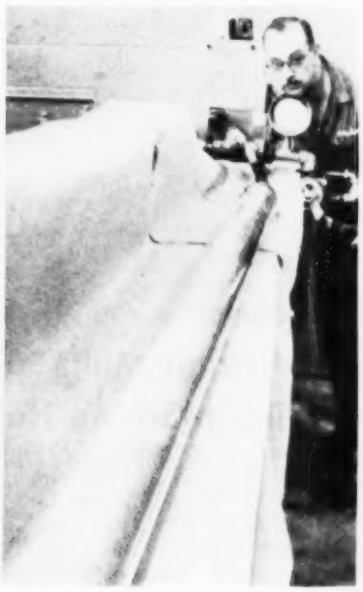
REQUIREMENTS—Only items in the Practical Ideas pages are eligible, and they must be submitted directly by the originator. Do not worry about your shortcomings as a draftsman, photographer, or author—every item will be edited in accordance with *American Machinist* standards and suitable illustrative or explanatory material added where needed. Readers will judge only the finished product—in terms of its usefulness to them.

WHO MAY ENTER — Anyone may enter except employees of the McGraw Hill Publishing Co, Inc, and those of advertising agencies or departments. Suggest to your employees that they submit ideas.

HOW TO ENTER — Send all entries to "Practical Ideas Editor," American Machinist, 330 West 42nd St, New York 36, N.Y.

New Shop Equipment

Materials and Parts



Metal Tubing Is Flattened for Shipment, Inflated for Use

A new type of thin-wall seamless metal tubing can be rolled flat, shipped as sheets or coils, and inflated to size at the point of use. The strip tubing, to be known as "Strubing" will be produced on an experimental basis this fall by Calumet and Hecla.

Two major advantages of the new material, according to the manufacturer, are:

• Thin-wall tubing can be shipped more economically. For instance, all the ductwork for the heating system of a seven-room house could be shipped in a box the size of an orange crate instead of trailer-truck loads.

• The cold rolling process used to make Strubing is an economical way of producing thin-wall tubing of materials and in thicknesses either unavailable today or available only at prohibitive cost.

Strubing can be made in sizes smaller than the lead in a pencil or large enough for a man to walk through, and as thin walled as metal foil or as thick as conventional pipe. It can be shipped in lengths up to 15,000 ft.

In manufacturing Strubing, the first step is to make conventional tubing which is then passed through a rolling mill where it is flattened into ribbon form. The rolling process elongates the original tube by making it thinner without changing the ID. The more passes through the rolls, the thinner the Strubing. The diameter of the Strubing is limited only by the size of the starting piece, which in turn, is limited only by the capacity of the rolling mill. An 800-ft roll of ½-in. dia tubing can be rolled into a 3000-ft flat coil of Strubing that can be inflated to ½-in. tubing with a wall thickness of less than 1/64 in.

Methods and equipment used to inflate Strubing vary according to the application of the material and its dimensions. The company's engineers have used hydraulic pressure, air pressure, and mechanical means. In some sizes, Strubing can be inflated by using tap water pressure.

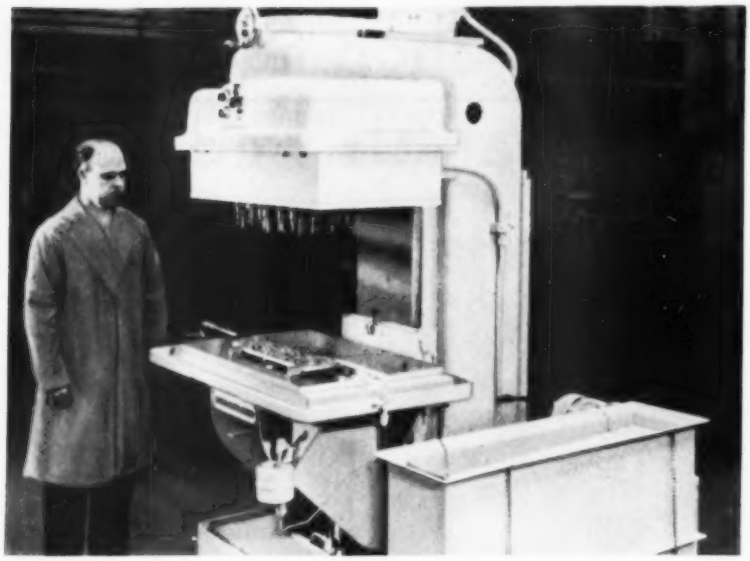
The cold rolling process produces a pair of ribs on the outside of the tubing. These ribs, which provide additional stiffness to thin-wall tubing, appear when the Strubing is inflated and run its entire length. If desired, the ribs can be removed as the Strubing is being formed.

The new material is expected to be particularly suitable for cont nuous manufacturing operations. Typical uses for small diameter Strubing might include instrument lines, automotive tubing, mechanical pens or pencils. Made of stainless steel alloys or exotic metals, Strubing could be used in the manufacture of light-wall large-diameter, seamless rocket and missile bodies.

Other suggested applications include: temporary piping on construction projects, field irrigation pipe on large farms, ductwork and conduits in building construction, low-cost pipe lining for the process industries, inner tube to repair leaky sewers and water mains, and packaging material in the frozen food and canning industries.

Wolverine Tube Div of Calumet and Hecla, Inc, 17200 Southfield Rd, Allen Park, Michigan

MORE DATA? Circle 51, inside back cover



Sundstrand Multi-Spindle Precision Boring, Drilling Machine Has Gearless Work Head

This precision multiple spindle drilling, boring, reaming and tapping machine is equipped with quick change heads that don't require gearing to drive the work spindles (thus making minimum center distances between spindles possible). Machine is designed for work on non-ferrous metals. Machines come in two sizes, offering a 18 x 36-in. head or a 9 x 14-in. head. Heads on both machines can be changed completely in 15 to 20 min.

A unique feature is a wobble plate spindle drive that eliminates all gearing in work heads. This makes it possible to develop relatively low cost head assemblies, using low cost spindles and parts, thus lower tooling costs. In addition, in the event of a major changeover, about 75% of an obsolete head can be salvaged and applied to new jobs. Complete drill heads temporarily out of service will store compactly.

Tolerances to 0.0002 in. are attainable for spatial relationship, shoulder depth and hole size. The accuracy built into the heads and fixtures is said to permit major manufacturing economies by reducing inspection costs.

Minimum center distance depends on the size cartridge required by the individual work spindles. Four standard cartridge sizes are available: $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$ and 1 in., for minimum center distances of 9/32, 17/32, 25/32 and 1 in., respectively.

Feed rate (drilling, rough and semi-finish boring) in aluminum and magnesium is 0.008 in. per rev. Finish boring is done at 0.0005 to 0.001 in. per rev.

Sundstrand Machine Tool, Division of Sundstrand Corp, Belvidere, Ill

MORE DATA? Circle 52, inside back cover

Heliweld Holder Gets Into Confined Spaces Easily

Development of a 350-amp Heliweld holder, said to be as small as most 200-amp holders, has been announced by Air Reduction Co. The H35-B holder is water cooled, can be used to weld stainless steel, aluminum, copper, magnesium and other special metals and alloys. Welding range varies from paper-thin thickness to $\frac{1}{8}$ in. or more. A completely enclosed water cooling system minimizes coolant leakage, and employs transparent plastic tubing on all hose assemblies so that flow of cooling water can be checked at all times.

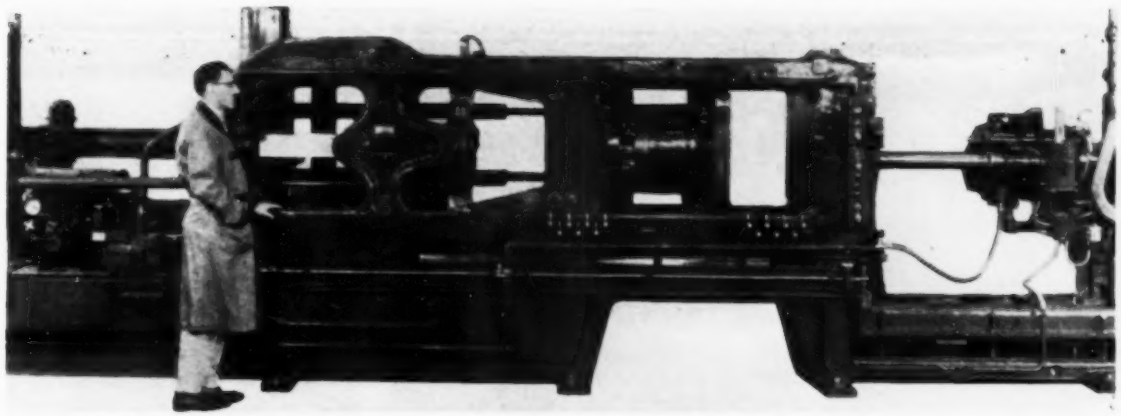
Body of the holder is of high-temperature resistant plastic designed to withstand temperatures to 500 F. Holder is rated at 350-amps dc or 300 amps ac. It will accept tungsten electrodes of 0.020-in. to 5/32-in. diameter, in lengths from 2 in. to 7 in., for use with argon or helium shielding gases. Holder has a minimum of $2\frac{7}{8}$ in. interference when using a 2-in. collet cap assembly and short nozzles. Stub loss with short nozzle is less than 13/16 in. Coolant system hoses are equipped with nuts and glands for easy removal.

Air Reduction Sales Co, Division of Air Reduction Co Inc, 150 E 42nd St NY 17, NY

MORE DATA? Circle 53, inside back cover

AUTOMATIC PIPE WELDING MACHINE produces sound welds with full penetration without the use of back-up rings. Machine is said to weld pipe faster and at less cost than ever before. High speed machine welds joint of 4-in. pipes in 11 sec. Welder handles all pipes from 4 in. to 11 in. OD. Head can be made to oscillate automatically back and forth across weld width to insure complete filling. Torch can be tilted away for service without disturbing pipe in the machine—*Aluminum Company of America, 1501 Alcoa Building, Pittsburgh 19, Penna*

MORE DATA? Circle 54, inside back cover



Aluminum Die Caster Features Extra-Large Die Opening

An aluminum die casting machine, said to have twice the die opening of any machine of comparable tonnage, has been introduced by Lester-Phoenix Inc. Machine delivers 450-ton clamping force and provides a die opening stroke that is adjustable from 8 in. to 30 in. Castings weighing as much as 16 lbs, such as rotors with long shafts, washing machine agitators and transmission housings, are examples of deep draw parts requiring high locking pressure that are within machine's capacity. The completely exposed hydraulic system is powered by a 30-hp motor and incorporates a 2000-lb booster pump. Hydraulic ejector can apply a force up to 30 tons to expel finished castings. Hydraulic core-pull headers are offered as optional equipment. Time for a complete casting cycle ranges from 6.7 sec for 8-in. die opening to 8.5 sec for 30-in. die opening. Injection shot end of machine is hydraulically adjustable from center to 6 in. below center. Both shot pressure and shot speed are adjustable. A nitrogen accumulator in the pre-fill system is said to produce high initial speed and final impact to yield high density castings with good surface finish. Maximum die height is 30 in. adjustable to 8 in. Total daylight is 60 in. on Model HP-450X-SF.

Lester-Phoenix Inc, 2711 Church Ave, Dept N-41, Cleveland 13, Ohio

MORE DATA? Circle 55, inside back cover

Adjustable Wall Thickness Bushings Provide Exact Fits

Adjustable wall thickness bushings, consisting of a series of alternate male and female rings, permit radial dimensions to be varied and provide exact fits without machining.

Applying compressive force to the ends of the bushing reduces the ID by reducing the diameter of the male segments and increases the OD by increasing the diameter of the female segments. All segments are slit axially.

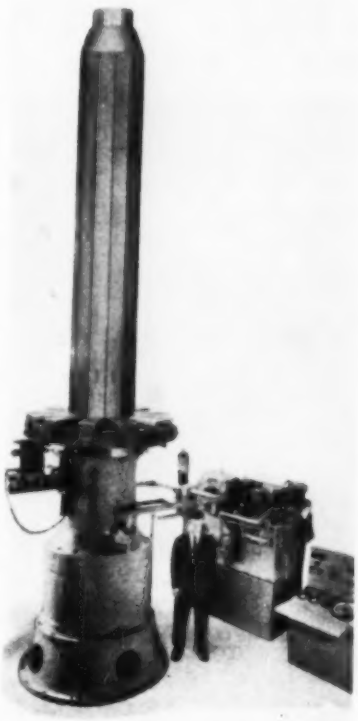
They are available in a wide range of materials including powdered metals, bronze, nylon, teflon, stainless steel. Some applications are: close tolerance fasteners; anti-backlash hinge and pivot pins; salvage of oversize holes; replacing taper pins and pressed-in-place pins or bolts; sealing around bolts; shaft clamps; structural steel fabrication.

The bushings are designed for use in industrial, aircraft, and construction fields for both OEM and maintenance applications. They can be applied anywhere threaded fasteners are used.

Globe Bushing Corp, 12036 Vose St, N Hollywood, Calif

MORE DATA? Circle 56, inside back cover

Grotnes Hydraulic Expander Has 16-ft Jaw, 1580-ton Pull



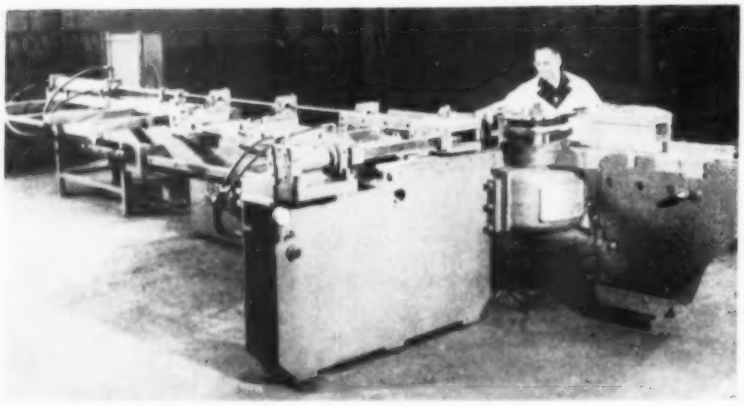
This hydraulic expander, with 16-ft jaw and 1580-ton drawbar pull, is designed to handle missile parts that previously could not be accurately sized and straightened because of their excessive length, small diameter, heavy wall thickness and high material yield strengths.

The drawbar pull can expand, with cone angle supplied, 40 sq in. of material with a yield strength of 100,000 psi. The machine can process an infinite variety of die shapes and sizes on parts with 36 to 74 in. ID.

Expanded jaw diameter can be set in 0.001-in. increments with an electro - hydraulic - mechanical control system. After a setting is made, the part is expanded and jaws and dies are brought into low-pressure contact with the part in order to measure it. The measurement is read off a control panel dial. If the setting is correct, the part is removed; if not, the diameter is reset and the part again expanded and measured. The expander, weighing 45 tons and measuring 29 ft over all, is installed at Douglas Aircraft.

Grotnes Machine Works, Inc, 5454 N Wolcott Ave, Chicago 40, Ill

MORE DATA? Circle 57, inside back cover

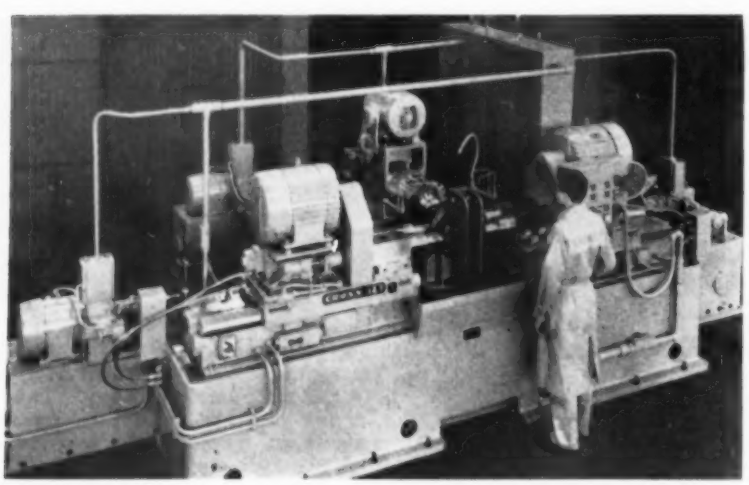


Hydraulic Bender Line Specially Designed To Bend Tubing for Aircraft and Missiles

A new line of precision hydraulic benders has been announced by Pines Engineering Company. Designed especially for bending tubing for aircraft and missiles, the four new machines will handle tubing of 1½-in, 3-in., 6-in., and 8-in., diameter. Machines are capable of making tight radius bends repeatedly to ¼-deg accuracy in 180 deg. Setup time and reject loss are said to be cut substantially by use of a hydraulic, direct-acting pressure die. A gage tells the exact amount of force on the pressure die required to bend a part, which makes subsequent setups possible without costly experimental waste once the correct pressure has been recorded. As a bend is made, the pressure die and holder "float" slightly, automatically compensating for variations in wall thickness. Since the pressure die moves with the work, scratches or draw marks will not appear on the finished part. The direct-acting die also reduces the tendency for tubing to wrinkle or rupture during a bend, since it applies pressure directly in line with the tube centerline. Precise control of pressure is said to make machine especially suitable for bending thin-wall tubing. A kit is also available for adapting existing Pines Model 2 and 4 benders.

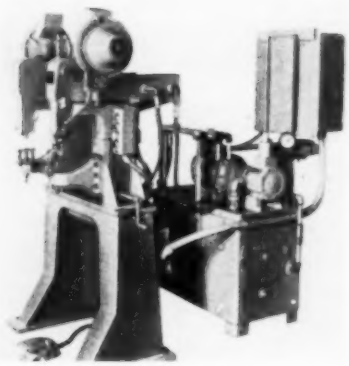
Pines Engineering Co Inc, 601 Walnut St, Aurora, Ill

MORE DATA? Circle 58, inside back cover



FLEXIBLE PRODUCTION SCHEDULING in machining two types of differential carriers is made possible by three Cross boring and facing machines, which are able to produce either part. Operations performed on the differential carriers are of high precision, involving tolerances to 0.0002 in. and a surface finish of 50 microinches. Machining includes boring, facing and grooving operations.—*The Cross Co, Box 3835, Detroit 5, Mich*

MORE DATA? Circle 59, inside back cover



Dual Riviter Sets Two Rivets At 1½ to 18-in Spacing

Dual Riviter, hydraulically powered, can be adapted to a wide range of setups. During each cycle the HRD Dual Riviter will set two ¼-in. solid steel rivets, fed from two 10-in. hoppers. Operating cycle is 0.8 sec at 420 psi (maximum operating pressure 1000 psi). The dual riveting stands have 8-in. throat depth, are adjustable for center to center distances of 1½ to 18 in.

Tomkins-Johnson Co, Jackson, Miss

MORE DATA? Circle 60, inside back cover

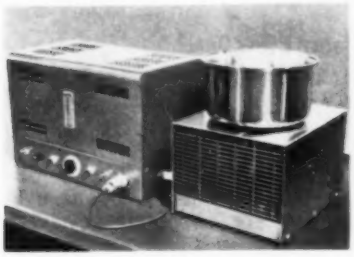
"Crab" Fork Truck Will Travel in Any Direction

New "Crab" truck may be an answer to restricted-space materials handling problems, with steering that permits traversing in any direction, at any angle. Truck is equipped with "stereo-matic" steering and twin drive motors, so that one control lever provides forward and reverse turning without use of the steering wheel. Angle and side steering are controlled with steering wheel. Bulky, odd-shaped loads can be carried across truck's forks and moved sideways down an aisle. A reaching-type fork attachment can swing the load 30 deg to either side, as well as reach over a stack to pick

up a load stacked behind it. A tilt device is available as an optional feature to cradle the load. Truck's overall length of 43 in. will permit it to operate in pallet rows, picking up 42-in.-wide loads far down the row. With an overall length of 65 in., the truck can turn completely around in a 70-in. circle. Loaded, forward speed is 4 mph; lift speed 22 fpm.

Automatic Transportation Co, 149 W 87th St, Chicago 21, Ill

MORE DATA? Circle 61, inside back cover



Ultrasonic Cleaner Offers Wide Operating Applications

Ultrasonic cleaner is available with interchangeable lift-out tanks ranging in capacity from 2 quarts to 6 gallons. Tanks are of stainless steel, and available in either round or rectangular shapes. A special, patented transducer produces frequency of 20 KC/sec. The transducer consists of over 200 separate nickel elements attached directly to the cleaning tank. In continuous operation it will not overheat low-boiling, low-flash or toxic solvents. High thermal stability of nickel elements in transducer permits use of solvents at temperatures to 400 F. The low operating frequency of 20 KC/sec is said to give superior cleaning action.

Blackstone Corp, Jamestown, NY

MORE DATA? Circle 62, inside back cover

Geneva Drives For Indexing In High-Speed Automation

Accurate indexing, positive locking and smooth operation make new Geneva mechanisms suitable for indexing high speed, automated equipment, according to the manufacturer, Genevamatic Engineering Corp. Three to 24 indexing stations are available, for center distances of 3 to 6 in. in $\frac{1}{2}$-in. increments.

Genevamatic Engineering Corp, Box 10386, Tampa 9, Fla

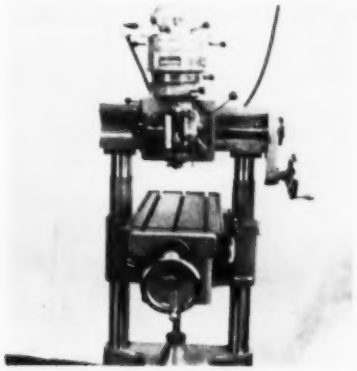
MORE DATA? Circle 63, inside back cover

Multi-Mike Measures Groove Widths, Locates Internally

This new "Multi-Mike" internal micrometer will measure cylinder groove and land widths, O-ring widths, and groove and keyway locations. Accuracies are possible to 0.0005 in. Measuring range varies from 0.050 in. to 1.050 in. for groove widths, and from zero to 1.000 in. for lands and distances between grooves.

Navan Products Inc, 900 North Sepulveda, El Segundo, Calif

MORE DATA? Circle 64, inside back cover



V-Mill Features Rigid Design For High-Precision Milling

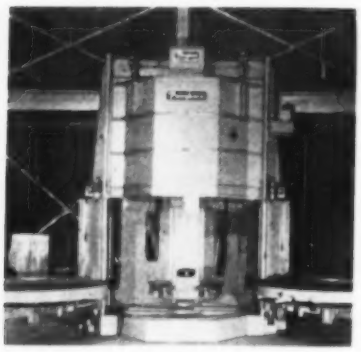
Two column design of this new Williams & Husey V-Mill contributes to good rigidity and high precision performance. Both table and cross slide V-ways are hand scraped for accurate, straight line motion. Handwheels are positioned for ready access, with 5-in. dials graduated in thousandths. A variety of milling heads is offered as optional equipment. Specifications: table 14 x 36-in. with 20-in. travel; range 16-in. cross travel, 17-in.-vertical travel, 4-in.-spindle travel. Price is $2495.

Williams & Hussey Machine Corp, Clinton St, Milford, NH

MORE DATA? Circle 65, inside back cover

ROLLER LEVELER PRECISION-FLATTENS and corrects ferrous and non-ferrous sheets and strip, including tension leveling of coil stock. Machines are available for all widths, and gages from 0.001 in. to 0.750 in. Symmetrical arrangement of rolls allows machine to be reversed at any time without adjustment. Burnish marks caused by severe metal entry are said to be eliminated. Motorized adjustments permit remote control in processing lines—*Sutton Engineering Co, First National Bank Building, Pittsburgh 22, Pa*

MORE DATA? Circle 66, inside back cover



Twin Table Blast Cleaner Speeds Cleaning Operation

While one casting is being blast-cleaned inside this new "Rotoblast" room, another can be readied on a second cleaning table outside the machine, making possible a substantial reduction in lost time. After cleaning, part and table are kicked out of cleaning chamber, and table latches in the out position. Twin table then enters chamber with its castings for cleaning. Castings up to 5 tons, and measuring up to 8 ft dia by 3½ ft high can be accommodated. Inside cleaning chamber, two rotoblast wheels with 30 hp motors throw 100,000 lbs of abrasive per hr, as casting rotates with cleaning table. Spent abrasive is removed by a scraper and reclaimed. Optional handling aids include a hydraulic unit to move tables into and out of chamber.

Pangborn Corp, Hagerstown, Md

MORE DATA? Circle 67, inside back cover

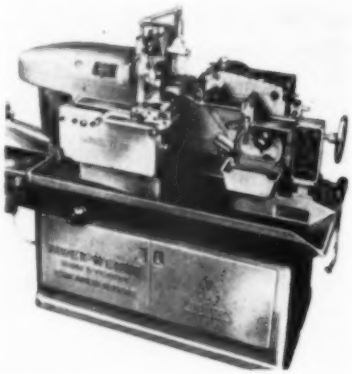
Comparator Designed for Spot Checks, Small Lot Inspection

RCA's Limit Signalling Comparator, Model 765, is designed for receiving and small lot inspection or for spot checking production runs. It can be used with standard height stands or special fixtures for manual inspection or for automatic in-process or post-process gaging and segregation. It can also be adapted for air gaging.

Nine different gage heads are available, permitting direct readings ranging from 0.000050 in. per dimension with the Type A-1 to 0.001 in. per dimension with the A-20. Full scale deflection of the meter is a direct 20-v change in the gage output, providing greater accuracy and repeatability than circuits requiring signal amplifiction. Setups can be made in seconds using any single part of known dimensions because the gage is linear over the full scale.

Radio Corp of America, Industrial and Automation Division, 12605 Arnold Ave, Detroit, Mich

MORE DATA? Circle 68, inside back cover



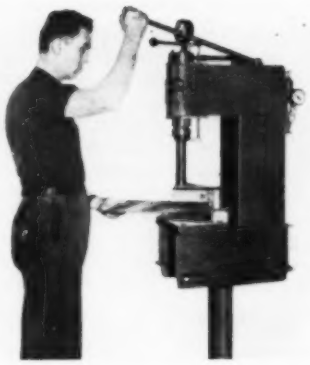
Index of Germany Introduces Two Single Spindle Automatics

Two new models of automatic screw machines have been introduced by Index-Werke (Germany). Both machines are similar in basic open front construction, but differ in bar capacity and speed. The C 19 handles bar stock up to ¾ in. dia; the C 29 has a capacity of 1 in. and can be equipped with an outside feeding attachment which enables bars up to 1 3/16 in. dia to be machined.

New features include an overload clutch and cut-out device for the camshaft and a simplified setup system. Spindle speed range on the C 19 is from 38 to 5300 rpm and on the C 29 from 28 to 3750 rpm. There are 30 high range speeds, which can be combined with 16 low range speeds. Wide range of speeds and extreme rigidity of the machine make possible full use of carbide tools. Spindle speeds and direction can be selected without changing the polarity of the motor or using a tumbler gear.

Wickman Products Corp, 10325 Capital Ave, Oak Park 37, Mich

MORE DATA? Circle 69, inside back cover

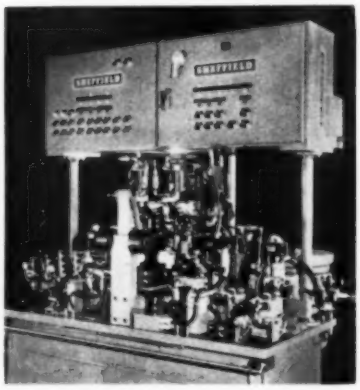


Bench Press Operates At 20 Strokes Per Minute

This 10-ton, hydraulic bench arbor press is designed for speed and ease of operation in a wide range of bending, straightening, forming, and punching applications. The hand-operated press can be cycled at over 20 strokes per min. The air-driven ram comes down to meet the work in a fraction of a second when the operating handle is raised. Then, when the handle is lowered hydraulic pressure performs the press operation. A spring return moves the ram back to its starting position. Standard equipment includes a pressing plate and two matched V-blocks for straightening and bending operations. Floor stand in photo is optional.

K R Wilson Inc, Arcade, NY

MORE DATA? Circle 70, inside back cover



FIVE COMPONENTS of an automobile distributor vacuum contact arm are automatically assembled at the rate of 900 units per hour. Sequence of operations is place washer on arm, add diaphragms, add and stake retainer ring, coat with sealing compound—*Sheffield Corp, Subsidiary of Bendix Aviation Corp, Dayton 1, Ohio*

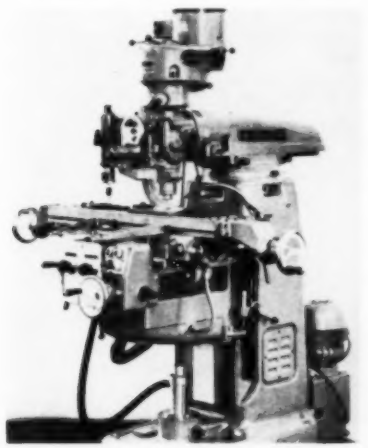
MORE DATA? Circle 71, inside back cover

New Power Slitting Shear Comes in Three Sizes

This new power slitting shear has a deep throat and rugged, easily adjusted back gage. Three models are designed to handle 10, 14 and 20-gage mild steel, respectively. Each machine has two interchangeable cutters. Back gage is clamped to both sides of the machine frame to provide maximum strength. Back gage may be removed quickly for free-hand slitting if desired. Easily read etched scales, one on each side of the machine, permit direct reading and quick setting of any cutting width from 1½ in. to 30 in. A spring-loaded roller automatically keeps the sheet in proper alignment for straight, accurate cuts.

Beverly Shear Manufacturing Co, 3004 W 111th St, Chicago, Ill

MORE DATA? Circle 72, inside back cover

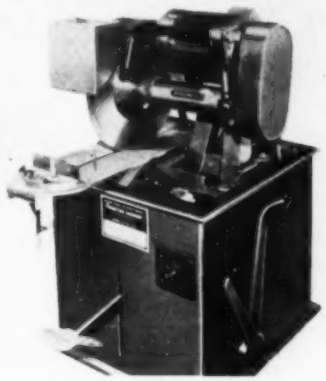


3-D Milling Machine Duplicates With 0.0012-in. Accuracy

New duplicating Milling Machine performs three-dimensional copying at low cost. The Italian-made machine is said to be suitable for both toolmaking and automatic cycle production, providing a copying precision of 0.0012 in. Machine will copy from masters made of plaster. The vertical, longitudinal and cross feeds are all hydraulically operated, and can be preset for automatic operation. At the end of each cycle the machine stops itself. Rapid traverse is provided for the longitudinal feed, while the hydraulic cross feed is available in increments of 0.002 to 0.004 in. Working surface of table is 43 x 10 in., with 15 in. between table and spindle. A special sheet templet holder is provided for two dimensional work. Designated the Supermill Duplomatic, the machine is said to produce work of excellent finish.

S&S Machinery Co, 150 53rd St, Brooklyn 32, NY

MORE DATA? Circle 73, inside back cover

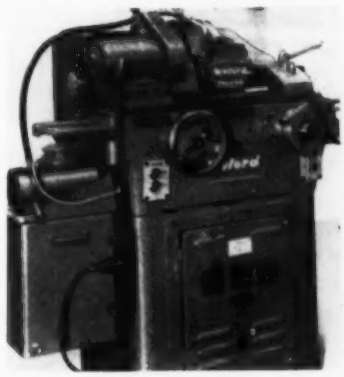


High Speed Cut-Off Saw Needs No Clampdown or Coolants

New cut off saw will cut all shapes of carbon, alloy and stainless steel at high speeds without clampdown, coolants or loss of control. Saw blade is said to produce a semi-milling action instead of the scraping or abrasive action of conventional units. Result is a smooth, practically burr-free cut without drag. Blade is reported to cut so fast that stock cannot absorb enough heat to change temper, thus no coolants are needed. With drag eliminated, no clamping devices are needed; cuts are made with stock simply lying on cutting table. Saw has single-cut capacity to handle 4 x 4 x ½-in. angles; 6-in. x 12.5-lb I beams, 1⅝-in. dia bars; and 12 x ½-in. plates. Larger pieces can be cut with a second pass. Machine will cut 6 x ½-in. mild steel bar in 2 sec, or a 6-in. x 12.5-lb I beam in 9 sec. Saw is designated Model 8A Promacut, Multi-Purpose.

Production Machinery Inc, Box 322, Oakton Station, Des Plaines, Illinois

MORE DATA? Circle 74, inside back cover



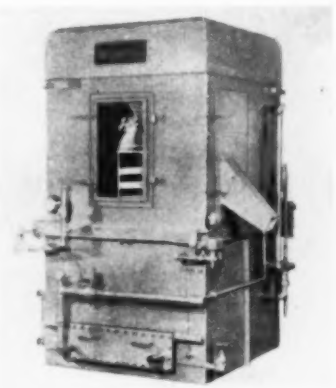
English Cylindrical Grinder Precision Grinds Small Parts

Myford MG12 Cylindrical Grinder, with a capacity of 3 x 12 in. between centers and a swing of 5 in., is said to combine toolroom precision with high production capacity.

The grinder can obtain finishes to 3 mu in. and repetitive accuracy to 0.0001 in. Using the live spindle, parallelism and roundness are held to millionths. Features include a hardened and thread ground feedscrew with forced lubrication and fine feed adjustments to dead stop to 0.000025 in. Fixed workhead is powered by dc drive. Wheel and workhead spindles rest in long taper phosphor bronze, handscraped front journals and twin angular contact preloaded bearings in the rear.

Bentley Industrial Corp, 41 E 42nd St, NY 17, NY

MORE DATA? Circle 75, inside back cover



Machine Coats Nails and Small Parts Six Times Faster

Said to be the first production machine of its type ever placed in operation, Manpro Vibra Nail Coating Machine paints or coats nails and other small parts. Nails enter coater

automatically after cleaning, are coated and dried as they travel 54 ft up a spiral elevator inside a 4 x 5 ft tank. Nails emerge clean, separated and dry so they will not stick when packed. Machine coats parts six times faster than previously possible, according to manufacturer.

Manpro Corp, 1360 Hilton Rd, Detroit 20, Mich

MORE DATA? Circle 76, inside back cover

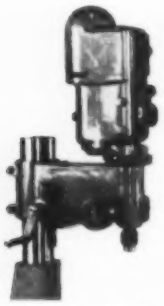
Center Holding Fixture Speeds Tool Grinding

Adjustable fixture aids accuracy in grinding or inspecting and is said to simplify sharpening and backing off of end grinding operations. Use eliminates need for collet or chuck.

Unit offers the accuracy of a dead center holding device and has a work capacity of 6-in. dia and 16-in. length. Length adjustment is clamped against spring pressure to prevent end play during grinding. It can be mounted on the universal vise of any tool and cutter grinder.

Wetmore Tool & Engineering Co, 5320 E Washington Blvd, Los Angeles, Calif

MORE DATA? Circle 77, inside back cover



ARBOGA DRILLPRESS (Swedish) EV-10 with drilling capacity in steel of ⅜ in. has infinitely variable speed from 1200 to 7200 rpm. Swing is 18 in., quill travel 3 in. Max distance from spindle to table, 12 in., table size, 10 x 17 in. —*Distributed by Homestrand, Inc, 9 Addison St, Larchmont, NY*

MORE DATA? Circle 78, inside back cover

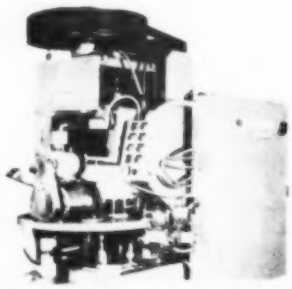
Orbital Electric Sander Introduced by Sundstrand

Model EO 900 is a high-output unit for continuous one or two-hand operation on single-phase, 15-v ac. Design of the single-phase motor insures constant operating speed without belt or gears, provides high starting torque, and is overload-proof.

Special sanding paper sizes are not required since the unit uses one-half a standard sheet. Eight interchangeable pads are available for max efficiency on a variety of finishing operations. Bearing lubrication lasts through approx 1000 hrs of operation.

Sundstrand Machine Tool Division of Sundstrand Corp, 2531 Eleventh St, Rockford, Ill

MORE DATA? Circle 9, inside back cover



Nut Tapping Production Increased With Flexible Tooling on New Line

New features of Zagar line include high production (as high as 50,000 nuts per hr tapped automatically at 100% efficiency); flexibility in tooling facilitates handling of nuts ranging in pitch from 8-32 through 1 in. -8; leadscrew control of the head with all taps rotating simultaneously.

Nuts are deposited into a hopper which feeds to one of six sections of a circular feed-index plate. In the second position nuts are brushed so that they are positioned flush with the top of the locator plate. At the third segment nuts are agitated to orient them firmly in the locator holes; at fourth station, oriented nuts are locked in the plate, and tapped at the fifth. The sixth segment is the discharge into a chute or other transporting mechanism. Tapping head in open position makes it possible for tap change to be done quickly. Head is powered by a 10-hp motor. Reverse is by heavy-duty, electrical reversing clutches.

Zagar, Inc, 23886 Lakeland Blvd, Cleveland 23, Ohio

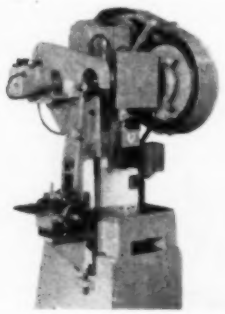
MORE DATA? Circle 80, inside back cover

Spring-Loaded Dead Center Has Adjustable End Thrust

Spring-loaded dead center of simple construction is said not to be subject to the ill effects of thermal expansion of mandrels or work-pieces which produces excessive end thrust pressure. The end thrust pressure of this dead center can be adjusted to meet the requirements of each job. It is available in all common Morse taper sizes and can be supplied with straight or tapered shanks and carbide tipped points. All essential parts are lapped or honed to close tolerances.

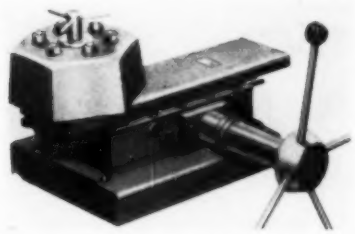
Chemtor Products Co, 32850 Northwestern Hyw, Franklin, Michigan

MORE DATA? Circle 81, inside back cover



HIGH SPEED BENCH PRESS has been developed for fabricating small precision parts. Press will operate at 450-900 strokes per min, and has a capacity of 5 tons. Other features: ⅜-in. eccentric stroke; 8-in. shut height; automatic lubrication system; electrically controlled air clutch—*Emhart Manufacturing Co, Hudson, NY*

MORE DATA? Circle 82, inside back cover



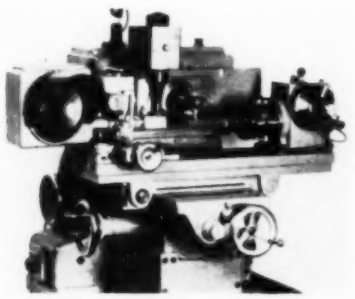
Improved Turret Attachment Introduced for Engine Lathes

Model 400 AK bed turret is designed to meet the needs of larger lathes in the 13 to 18-in. range. Installation converts engine lathes to ram-type turret lathes capable of multiple machining operations.

Mounted on a 5° tilt, the self-indexing six station head, when rotated, gives an increased clearance of the tool over the slide, allowing larger tools to be used. Ram length has been increased to 20-½ in. to provide greater bearing surface throughout the entire slide travel. In order to insure perfect alignment with the spindle hole, all tool holes are left blank for machining after the turret is mounted.

Precision Processing Co, 3269 Casitas Ave, Los Angeles 39, Calif

MORE DATA? Circle 83, inside back cover

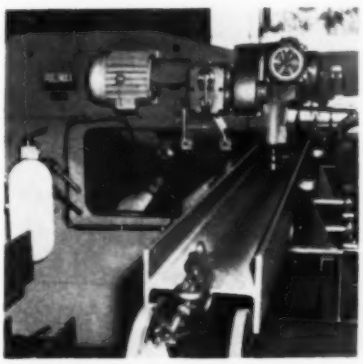


Punch Shaper Magnifies Machining Area Twenty Times

A projector on this new tapered-punch and form shaper magnifies machining operations 20 times, allowing close visual control by operator. In one setup, tapers can be machined within 3 degrees, while punch necks and other contours can be brought to a guaranteed tolerance of 0.00025 in. Shaper employs large dividing head with automatic circular feed and a coordinate chuck permitting the automatic machining of radii, angles and tapers. All controls are incorporated within machine and completely encased. Entire surfaces of workpieces may be machined without reclamping. Improvements over former model include 6 in. longer table, heavier tool arbor and carrier, and cobalt and carbide tool bits of various grades for machining tough punch materials. Specifications: speeds 50, 75 and 110 spm; working area 6 x 6¼ in.; stroke 0 to 6 in. Jersey K-15 Form and Punch Shaper.

Jersey Manufacturing Co, Livingston St, Elizabeth, NJ

MORE DATA? Circle 84, inside back cover

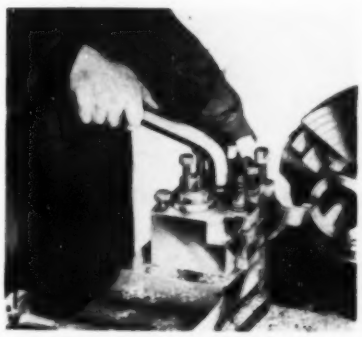


Machine Splits I Beams Automatically at 20 fpm

Designated Pullmax U-10, this new machine for splitting I beams has pushbutton controls for automatically starting, penetrating and cutting heavy metals. Machine will cut I beams at from 10 to 20 ft per min, and is said to leave a smooth, finished edge without distorting the I beam. Machine can also be used for circle cutting, straight shearing and other cutting and forming operations.

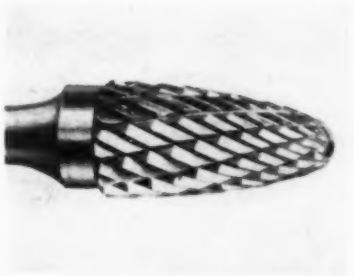
American Pullmax Co, 2455 N Sheffield Ave, Chicago 14, Ill

MORE DATA? Circle 85, inside back cover



GREAT RIGIDITY AND ACCURACY are obtained by locking this new universal tool holder against body of tool post. Swedish-made MALCUS tool holder fits lathes with 16 in. swing or larger —*Homestrand Inc, 9 Addison St, Larchmont, NY*

MORE DATA? Circle 86, inside back cover



New Design Carbide Cutter Said To Clean Welds More Effectively

Carbide cutter with alternate diamond pattern is reported to be especially effective in cleaning welds. According to the manufacturer, the new design with coarse cut grind permits fast, efficient cutting action and does not produce splinters when used on weldments.

It is said to penetrate the material faster, remove more stock, and will not chip out. Compared to normal diamond pattern cutters, the new tool is less expensive on initial costs and life is up to 300% greater. It can be reground easily with negligible loss of diameter.

M A Ford Mfg Co, Inc, Davenport, Iowa

MORE DATA? Circle 87, inside back cover

Combination Rotary-Index Table Has 24 Stations

Model 710-V rotary table serves in two-fold capacity. Designed as a power rotary table for surface grinding, it is also an index table with index combinations of 2, 3, 4, 6, 8, 12, and 24 stations. Indexing on a 10-in. circle is held to a tolerance of 0.0003 in. on 24 stations. An electric motor powers the table. Variable speed control is used for rotary grinding, while a forward-reverse switch clutch is provided for hand operation and indexing.

M&M Tool & Manufacturing Co, 1124 E 3rd St, Dayton 2, Ohio

MORE DATA? Circle 88, inside back cover

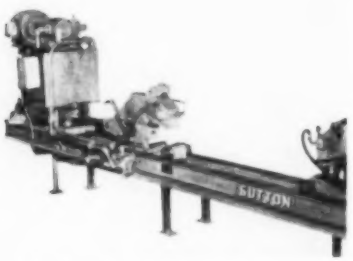
Hopperal Driver Has Built-In Automatic Feeder

Bench model incorporates a Hopperal small parts feeder built into the frame. It will feed screws, nuts, bolts, rivets, nails, and other fastening devices. Unit selectively orients the parts in the inner track and feeds them to the outer track for use in the assembly operation.

Model may be equipped with a solenoid, air or hydraulic powered driver which is used to drive, peen, press, or stake the part being fed into the assembly. It can be operated with hand or foot valves for semi-automatic cycling, or equipped with air or electrical controls for fully automatic cycling. Hopper is powered by a 110-v plug-in gear motor and has a capacity of 40 cu in.

Haberstump-Harris, Inc, 10163 Northlawn, Detroit 4, Mich

MORE DATA? Circle 89, inside back cover



20-Ton Hydraulic Stretcher Stretch-Straightens Extrusions

Sutton 20-ton hydraulic stretcher is designed to stretch-straighten extruded sections of aluminum and other metals at high production speeds.

Vertical jaw design provides a horizontal pass line through head and tailstock for easy material handling. Extrusions up to 100 ft long can be stretched-straightened up to the 20-ton pull. At less than 6 tons, speeds range up to 400 ipm. Headstock stroke is 48 in. Air operated jaws are interchangeable for different shapes. To save floor space, the hydraulic unit is mounted on top of the main cylinder.

Sutton Engineering Co, First National Bank Bldg, Pittsburgh 22, Penna

MORE DATA? Circle 90 inside back cover

Machine Stitches Metals And Non-Metallic Materials

Model N2F forms a wire stitch, drives it through the pieces to be joined, and clinches it on the opposite side. In addition to flat rolled and extruded aluminum, hot and cold rolled steel, stainless, soft sheet brass, and sheet copper, unit handles plastics, wood, and rubber.

Production rates average about 100 stitches per minute; machine is capable, however, of speeds from 280 to 325. Stitches can be applied to work to be joined perpendicular, parallel, or diagonal to the line of pull. Process requires no preparation of work; painted and galvanized surfaces are unaffected by application of stitches. Machine is operated by a fractional hp motor.

Acme Steel Co, 135th St & Perry Ave, Chicago 27, Ill

MORE DATA? Circle 91, inside back cover

PLIER-TYPE CLAMP has a two-way trigger release for simple one-hand operation. Model 462 is available with jaw openings up to 6-in. and holding pressures up to 1200 lbs — *Detroit Stamping Co., 340 Midland Ave, Detroit 3, Mich*

MORE DATA? Circle 92, inside back cover

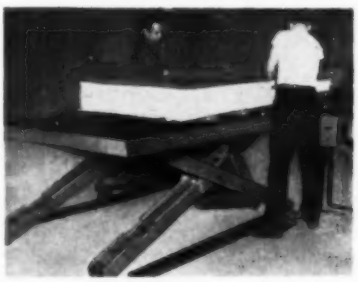
NCG Introduces Line of Eight Horizontal Electric Arc Welders

Line of eight horizontal type "Sureweld" electric arc welders in the low and medium price range features comparatively high open-circuit voltages which provide easy arc striking and excellent arc stability, according to the manufacturer.

Four models have built-in power factor correction capacitors that permit use of smaller input wires and fuses. Prices begin at $131 without accessories or electrodes. Four AC models provide welding current ranges from 20 amps in the smallest model to 295 in the largest. The four ac-dc models range from 20 to 290 amps.

National Cylinder Gas Div of Chemetron Corp, 840 N Michigan Ave, Chicago 11, Ill

MORE DATA? Circle 93, inside back cover



Autoquip Production Lift Speeds Feeding and Receiving

Automatic unit available in any platform size or lifting capacity, can be customized to feed and receive conveyors, presses, stamping machines. It requires no installation. In operation, the automatic controls may be used to raise and lower to desired speeds and stop at any height desired. It can be easily rolled to another position when required, and is completely flat when lowered all the way.

Autoquip Corp, 1150 S Washtenaw, Chicago 12, Ill

MORE DATA? Circle 94, inside back cover

5 Positive ways Asarcon® continuous-cast bearing bronze saves you money: 1) Exact lengths. Order Asarcon 773 (SAE 660) in exact lengths you need, up to 105″. No short-end scrap as from ordinary cast bars. 2) Close-to-size. Asarcon 773, in diameters from 1/2″ to 9″, gives you only 1/32″ to 3/32″ to machine off. 3) Less machining. Less stock to remove saves machining time and cost. 4) No blow-holes, pits, or shrinks. No sand to dull tools. No hard or soft spots. No loss of machining time or parts thrown away because of metal defects. 5) Less down-time. The better, more uniform properties of Asarcon 773 assure longer life of important machine parts, and fewer breakdowns. Asarcon 773 bearing bronze is immediately available from stock in 260 sizes, rods, and tubes. Special shapes can be made to order. Write Continuous-Cast Products Department, American Smelting and Refining Company, Barber, N. J. West Coast Distributor: Kingwell Bros., Ltd., 457 Minna St., San Francisco. In Canada: Federated Metals Canada, Ltd., Montreal and Toronto.

CONTINUOUS-CAST DEPARTMENT OF

ASARCO

AMERICAN SMELTING AND REFINING COMPANY

CIRCLE 230 READER SERVICE CARD

SELF-CONTAINED SLITTERS

YODER SLITTERS

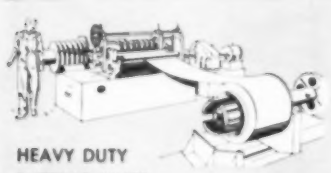
basic equipment for cost-conscious users of strip!

To help meet the demands of tight production schedules, YODER Slitters reduce mill-width stock quickly and economically to desired widths. If your needs are as low as 100 tons per month, time and manpower savings alone will offset the cost of your YODER Slitter in a matter of months, while reducing basic inventories. Compactly designed, standard YODER Slitters are built to handle standard coil widths . . . completely engineered lines for special requirements.

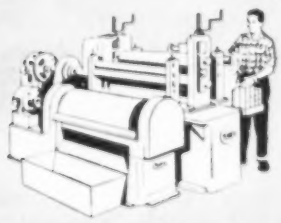
YODER accessories, such as coil cars, swivel unloaders, scrap choppers, scrap disposers, plate levelers and coil boxes, make stock handling fast and easy.

YODER also makes a complete line of Cold Roll-Forming equipment and Pipe and Tube Mills. To profit from YODER'S years of engineering and service experience, contact your local YODER representative or send for the fully illustrated descriptive, YODER Slitter Manual; it's yours for the asking. Write to

THE YODER COMPANY
5519 Walworth Ave. • Cleveland, Ohio



HEAVY DUTY
SLITTING LINES



SCRAP CHOPPERS

YODER ENGINEERING MANUFACTURING
ROTARY SLITTING LINES

Huck Fastener Installation Tool Develops 6000-lb Pulling Force

New fastener installation tool is hand operated and capable of developing a pulling force of 6000 lbs. The model 115 tool will install all Huck fasteners from 5/32 in. to ⅜ in. nominal dia, in both steel and aluminum (except Conical Keystone Lock blind rivet). Smooth operation is accomplished by a low-friction, ball screw mechanism.

Huck Manufacturing Co, 2480 Bellevue Ave, Detroit 7, Mich

MORE DATA? Circle 95, inside back cover

Versatile Head Can Operate As Automation or Conversion Tool

DMG (drill, mill, grind) head eliminates need for several single purpose tools. As an automation tool it can be mounted in fixed or building block systems for drilling, tapping, milling, boring, honing. As a conversion unit it mounts on most basic machines making it possible in many instances to complete a part in one setup.

Model 10324 weighs 50 lbs, overall length is 18 in. Continuous duty motor is 1½ hp 3 phase. Speed range is from 300 to 3000 rpm. Additional specifications include spindle No. 2 Morse taper; ⅜-in. drawbar through spindle; 360° positioning of spindle and gear drive.

Larmet Co, 108 Wiggs St, Griffith, Ind

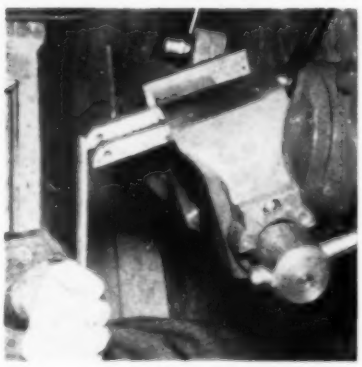
MORE DATA? Circle 96, inside back cover

Faster, More Powerful Air Impactool Now Available

New ⅜-in. capacity air powered impact tool is lighter and more powerful than previous models. Tool is designed to deliver 40% more power and 100% faster run-down than before. An improved impact mechanism and motor make higher performance possible. A nylon-composition, self lubricating trigger is said to give longer life than other types. Specifications: weight 5⅞ lbs; air pressure 90 psi. The square driver measures ½ in. across flats, and delivers 1200 impacts per min.

Ingersoll Rand, 11 Broadway, NY 4, NY

MORE DATA? Circle 97, inside back cover



DOUBLE-SWIVEL VISE makes it possible to work on another section of the same part without having to reclamp it. First swivel allows main jaw sections to rotate fully. Second swivel in the base allows the whole vise to swing around—*Charles Parker Co, 412 Jordan St, Meriden, Conn*

MORE DATA? Circle 98, inside back cover

A Completely New Concept in Height Gage Design

STARRETT NO. 254 MASTER VERNIER HEIGHT GAGE

Here is a vernier height gage that can be used with supreme confidence in its master precision.

An exceptionally rugged, rigid, vibration-proof gage with new open-face, easy-reading vernier, flush-fitted to eliminate parallax errors . . . full-length fine adjusting screw controlled by a convenient knob on the substantial, natural grip base . . . Starrett satin chrome finish for no-glare, easy reading . . . quick-adjusting screw release for fast slide positioning...hardened and stabilized master bar (only Starrett provides hardened bars on vernier gages).

Shown used with a Starrett No. 711F Last Word Indicator, new No. 254 Master Vernier Height Gages are available in 12, 18 and 24-inch sizes, all reading direct from base over the full range.

Ask your Industrial Supply Distributor to demonstrate the many precision features of this new Starrett height gage. Call him for quality products, dependable service . . . or write for complete Starrett catalog. Address Dept. C, The L. S. Starrett Company, Athol, Massachusetts.

Starrett

PRECISION TOOLS

World's Greatest Toolmakers

Starrett Precision Makes Good Products Better

PRECISION TOOLS • DIAL INDICATORS • STEEL TAPES • GROUND FLAT STOCK • HACKSAWS • HOLESAWS • BAND SAWS • BAND KNIVES

CLARK CUTS DOWNTIME, REDUCES MATERIAL COSTS 25%

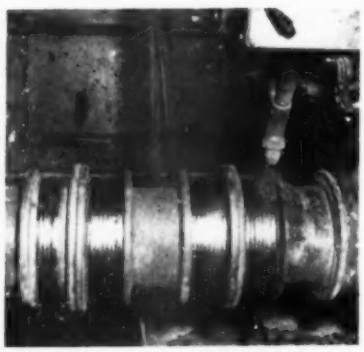
The Clark Machine and Welding Company, Inc., of Baltimore, Maryland, has a department which specializes in rebuilding industrial and construction equipment. They've grown in 25 years from a 4-man shop to the largest maintenance shop in Maryland—employing about 75 people. During that time they've tried just about every automatic hardsurfacing wire and flux available, and have had troubles ranging from high material costs to excessive downtime in the shop.

Rebuilding tractor rollers in the Clark shop. The fixture was designed and fabricated by Clark.

A. L. Ballard, Clark's welding foreman, "We've eliminated many production problems, cut costs and improved the quality of our work."

Work stoppages were caused when some welding wire would jam in the feed rolls of the automatic welder or the wire would stick. This, of course, not only caused the machine to be stopped, but affected the quality of the deposit as well.

Other granular fluxes with alloy wire were tried. Performance was better, but the alloy wire proved too expensive, according to Phillip Killen, Vice President and General Manager of the firm.



Al Ballard, the company's automatic welding foreman, has found that Lincoln agglomerated fluxes give him the most reliable performance. The fluxes not only cost 25% less than the most similar competing product, but they contain the alloying elements making it possible to use less expensive mild steel wire.

Mr. Killen states that the use of agglomerated fluxes and Lincoln automatic welding equipment have given his shop a definite advantage with consistently top quality work at a substantial saving.

HARDSURFACING INFORMATION MADE AVAILABLE

A series of How-to-do-it bulletins on Automatic Submerged Arc hardsurfacing are being published by The Lincoln Electric Company.

A basic bulletin, number 3200.1 on Automatic Submerged Arc hardsurfacing starts the series.

Specific information on hardsurfacing and rebuilding is presently available on the following items: tractor rollers, tractor idlers, mine car wheels, scraper blades, steel mill rolls, crusher rolls (with automatic), crusher rolls (with semi-automatic), Raymond bowl rolls, Raymond bowl rings, tractor treads and cement mill equipment.

Copies of these bulletins may be obtained by writing on company letterhead to:

The World's Largest Manufacturer of Arc Welding Equipment

LINCOLN

THE LINCOLN ELECTRIC COMPANY, DEPT. 2036 CLEVELAND 17, OHIO

Trico-Mist Coolant Unit Designed for Small Machinery

Type J, 5 in. high and less than 3 in. wide, designed for small precision drilling, tapping, and milling operations, is equipped with a 2-ft neoprene coolant line and mist generating nozzle. Mounting stud is provided for easy installation.

Unit has two valves, one to control air, the other to control flow of liquid coolant; it operates on shop airline pressure of 50 to 125 lbs. Plastic reservoir has 8-oz. capacity; one filling will reportedly last eight hours and longer.

Trico Fuse Mfg Co, 2918 N 5th St, Milwaukee 12, Wis

MORE DATA? Circle 99, inside back cover

Right Angle Nutsetter Has Automatic Torque Control

Model 14 ANS is reported to be practically free of torque reaction and converts easily to a two-way tool. Precise torque control is assured through a no-drift lock. Shut-off mechanism stops the air motor instantly and automatically when the nut or bolt has been tightened to torque specifications. Double-end spindle is available at no extra cost permitting removal of nuts by revolving the tool 180°. Unit weighs 5 5/16 lbs, is 16⅛ in. long. Speed is 275 rpm.

Cleco Air Tools, Houston, Texas

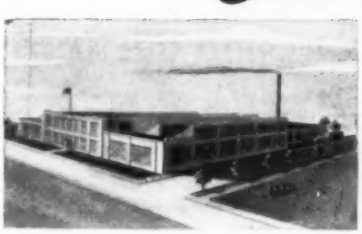
MORE DATA? Circle 100, inside back cover

for the man who's HAD IT

Columbus Die-Tool can help!

Many leading companies all over the United States are now availing themselves of our creative engineering staff, modern plant and equipment, to design and build their special tools, jigs, fixtures and machines. Over 50,000 square feet, filled with precision production equipment, enables us to build fine tools and special purpose machines to your exacting requirements. Increase the efficiency of your operation with special tools that do the job better—faster—more economically . . . designed and made by Columbus Die-Tool.

FREE: *New brochure listing complete facilities and equipment. Write today.*



Columbus Die-Tool

AND MACHINE COMPANY

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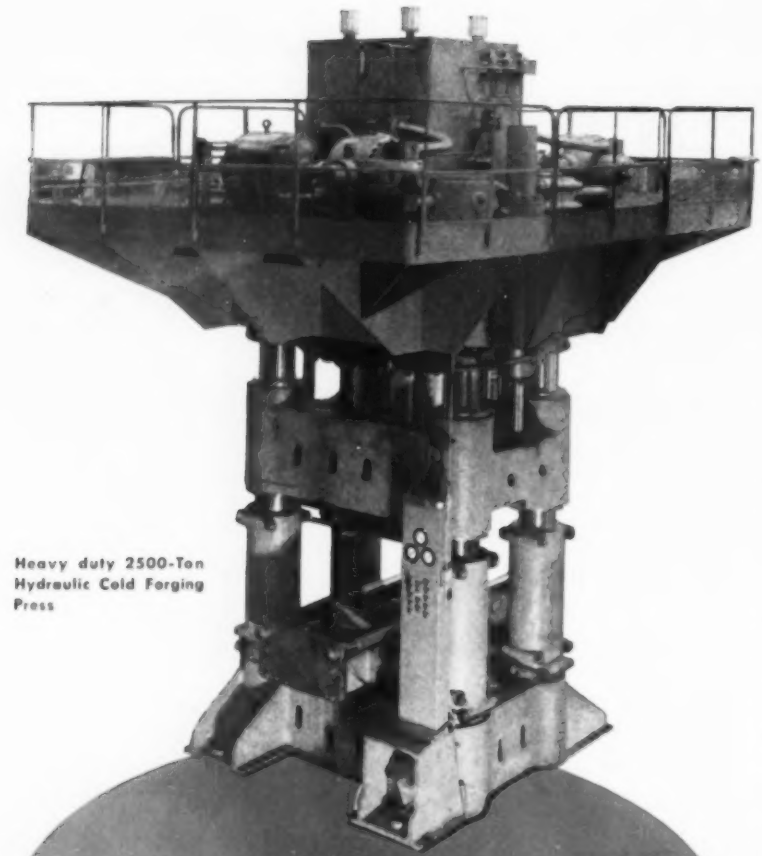
SERVING INDUSTRY SINCE 1906

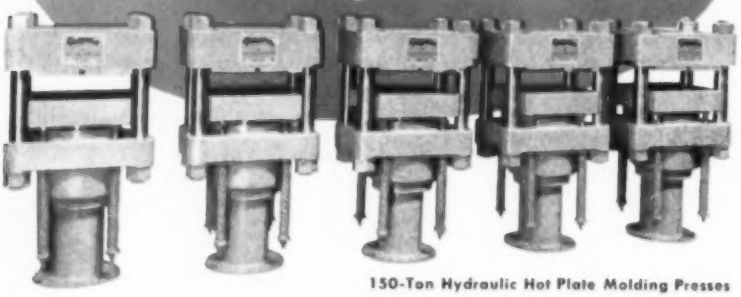
Designers and manufacturers of Jigs • Fixtures • Special Tools • Units for Machine Tools • Builders of Machine Tools Complete

CIRCLE 234 READER SERVICE CARD



Heavy duty 2500-Ton Hydraulic Cold Forging Press

from this mighty giant... to these mighty mites...



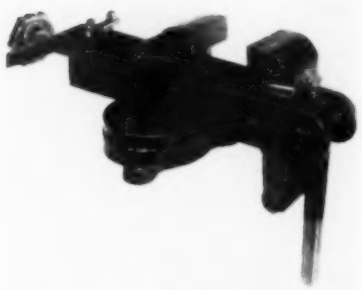
150-Ton Hydraulic Hot Plate Molding Presses

Oliver-Farquhar builds hydraulic presses in a wide range of types and capacities to give you what you want!

Remember too, Oliver-Farquhar engineered conveying systems will load and unload these presses automatically for maximum money-saving efficiency. Contact your Oliver-Farquhar machine tool distributor or write for additional information and our proposals.

THE OLIVER CORPORATION
A. B. Farquhar Division
Hydraulic and Mechanical Press Department
York 16, Pennsylvania

OLIVER Farquhar PRESSES



Quick Change Bench Vise Speeds Production

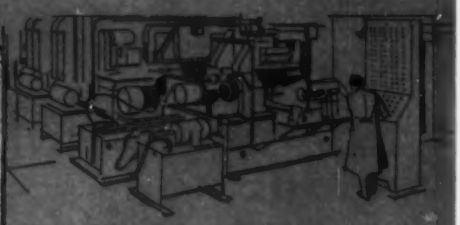
New open center vise is built without obstructions under the jaws, allowing work to be clamped either horizontally or vertically. Vise is built to take the same loads as ordinary, heavy-duty vises. A quick-change mechanism makes it possible to set the jaws at a predetermined position, so that pieces of like size can be inserted and released by moving a cam lever—a timesaver in multi-piece operations. Three sizes are offered, with jaws measuring 3 in., 5 in., and 6 in., and opening to 5 in., 9 in., and 10 in. respectively.

Stroudsburg Engine Works Inc, Stroudsburg, Penna

MORE DATA? Circle 101, inside back cover

AUTOMATION BEGINS HERE

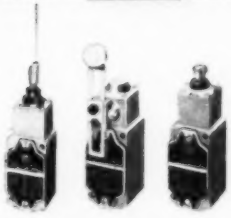
. . . Insist on Allen-Bradley accessories for continuous automatic production



In this broad line of Allen-Bradley accessories, each and every unit carries the traditional A-B trademark of *quality* that stands for trouble free operation. Rugged construction, and maintenance free, silver alloy contacts provide the reliability that is essential to the continuous operation of *your* automatic production machines.

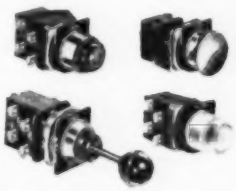
Profit from the experience of the leading machine tool builders . . . insist on Allen-Bradley *quality* motor control *all the way!*

Special push button panels can be assembled to your specifications.

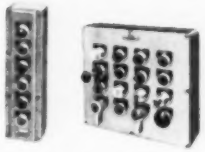


OILTIGHT LIMIT SWITCH
Bulletin 802T with sealed heads and bodies. Various operators.

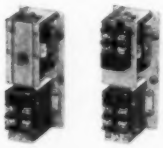
PRECISION LIMIT SWITCH
Bulletin 802 oiltight. Responds to very small operator travel.



OILTIGHT CONTROL UNITS
Bulletin 800T. Choice of push buttons, lights, and switches.



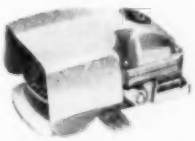
OILTIGHT CONTROL STATIONS
Bulletin 800T for up to 16 units in die cast aluminum enclosure.



PNEUMATIC TIMERS
Bulletin 849. Reliable and accurate. For on-delay or off-delay.

OILTIGHT PRESSURE CONTROL
Bulletin 836. For hydraulic systems with pressures to 5000 psi.

STANDARD DUTY PUSH BUTTONS
Bulletin 800. Up to three units, also pilot lights and switches.



FOOT SWITCH
Bulletin 805. In rugged die cast housing for toughest service.

ALLEN-BRADLEY
Member of NEMA

QUALITY MOTOR CONTROL

Allen-Bradley Co., 1310 S. Second St., Milwaukee 4, Wis. In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

COST-CUTTING PRODUCTION TEAM

The two-way answer to assembly problems

Here's a combination that slashes production costs and gets rid of assembly problems in a hurry—Milford Tubular Rivets made to high quality standards to assure a better finished product for you . . . Milford Automatic Riveters that can be quickly adapted to your particular assembly needs.

For the answers to assembly problems *. . . get in touch with Milford first.*

THE MILFORD RIVET & MACHINE CO.

MILFORD, CONNECTICUT • HATBORO, PENNA.
ELYRIA, OHIO • AURORA, ILL. • NORWALK, CALIF.

FIELD REPORT...

Dow Forms Metals Fabrication Div

Dow Chemical Co is setting up a new division for fabrication and semi-fabrication of magnesium, aluminum, and other metals. To be known as the Dow Metal Products Co, it'll replace the Dow Magnesium Products Department. Major manufacturing facility of the new division is the sheet and extrusion plant at Madison, Ill. Equipment there includes two 84-in. rolling mills and a 13,200-ton extrusion press that has been used to a limited extent in production of aluminum extrusion, mainly for aircraft, for the past few months.

Harvey Goldman & Co Marks 50th Anniversary

A Detroit used machinery company that assisted Henry Ford, Tom Buick, Louis Chevrolet, and the Fisher brothers in equipping their first plants is celebrating its golden anniversary this summer. Four generations of the same family have worked in the organization, one of the largest, as well as one of the oldest used machinery dealers in the country.

Hyman Goldman and his son Louis founded the firm in 1909 as the Riverside Machinery Co. For many years Hyman wouldn't even allow a machine to be painted, much less repaired, unitl it was sold, so that there'd be no possibility for misunderstandings. Grandson Harvey became active in the company in 1922, took over direction in 1933. Louis Stern, nephew of Harvey, and great grandson of Hyman, joined the firm in 1957. All management posts in the company are still filled by members of the founding family.

Goldman's was one of the initial companies in the 1920's to use the installment payment method of selling its products; in the '40s it introduced the sales policy of leasing used machines with option to buy; it was also one of the first concerns in the country to offer a 30-day guarantee with full return rights. In addition to used machinery, company today has a sales agency for new machine tools.

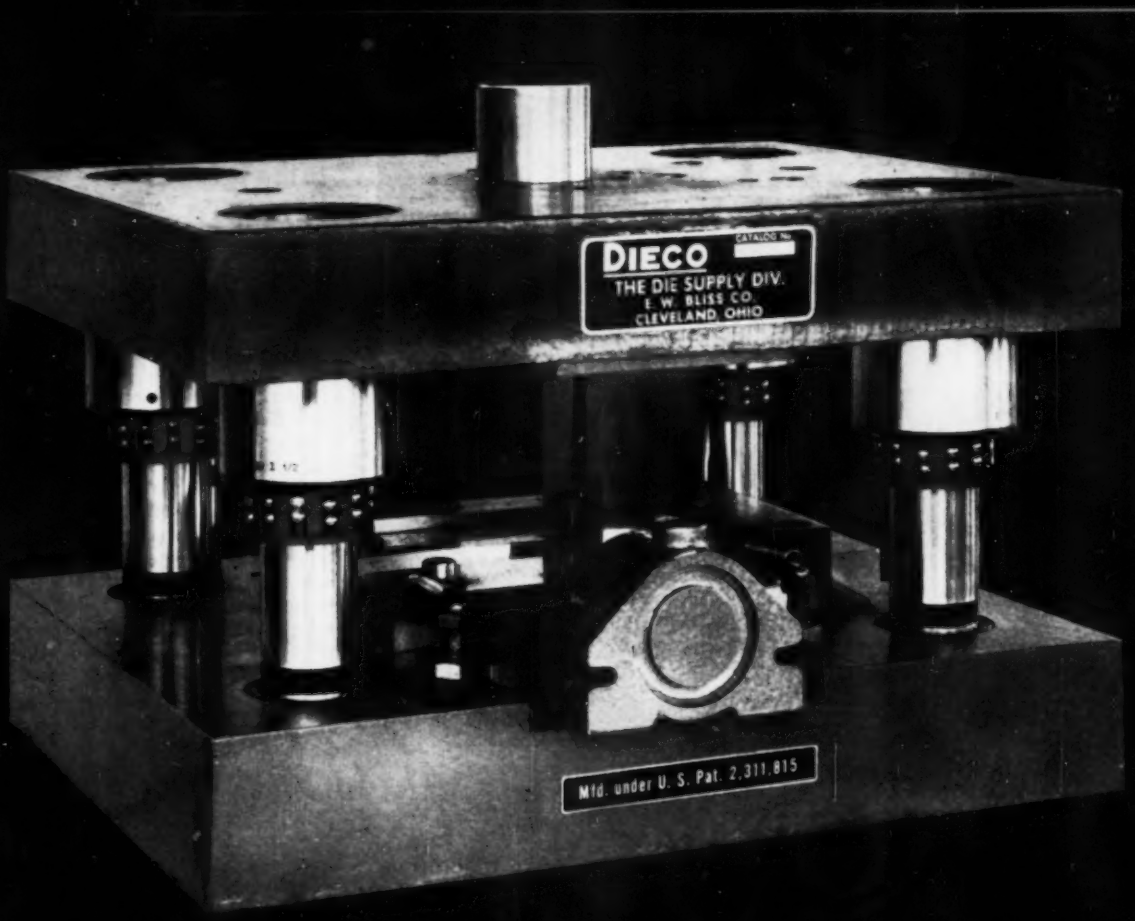
Metallurgical Research Center To Be Built at Du Pont, Baltimore

Fully equipped research center to speed development of high-temp metals for jet engines, rockets and missiles, and atomic power generators will be constructed at Du Pont Co's Baltimore plant. Installation will contain equipment to forge, extrude, roll, draw, and heat-treat such refractory metals as niobium, tantalum, titanium, zirconium, tungsten, and chromium. It'll be capable of producing mill products, ingots, tubes, rod, sheet, strip, and foil for

Michigan Tool Awards . . .

. . . honor "excellence in gear production"

Ten plants in eight industries and nine cities in the US have received the 1959 Honor Citations for "excellence in gear production and effective use of modern gear production equipment." Awards are sponsored annually by Michigan Tool Co, Detroit maker of complete gear production equipment. Here **James Cypher** (right), manager of Chrysler Corp's Kokomo (Ind) transmission plant, accepts the Honor Award for "excellence in gear production techniques" from **M R Anderson,** Michigan Tool's president. Awards committee cited Chrysler for its unique adaptation of the Shear-Speed gear cutting process to the cutting of many types of tooth forms in a variety of materials — aluminum, steel, and cast iron — for use in automobile transmissions.



New Bliss ball bearing die sets shrink hours into minutes in die making and changeover!

Here are seven reasons why...

- Negative clearance means longer die life. No die shifting. Misalignment is eliminated.
- Ball bearing construction speeds assembly and disassembly. Yet installation is conventional. Die builder doesn't work in reverse.
- Smooth even preloading prevents shock...assures alignment of punch and die. Off-set design reduces wear.
- Easy oiling and maintenance. Loosen the set screw, the retainer is out and back in minutes.
- Eliminates downtime caused by seized pins and bushings.
- Standard components—no need to stock or wait for specials.
- Existing sets can be easily and economically converted to Bliss-Dieco ball bearing design.

Mfd. under U. S. Pat. 2,311,815

Note: Bliss-Dieco ball bearing assembly can be stripped from guide post on inclinable or straight side presses.

Bliss' patented ball bearing die set has money and time saving advantages no other die set has—conventional or otherwise. It gives you more burr-free parts between regrinds... fewer rejects.

It's the most revolutionary change in bearing design to hit the die industry in years. Assembly and disassembly are a snap. Die making and tryout time are slashed. No more time lost because of seized pins and bushings.

Pre-loaded ball bearings provide *negative clearance* for perfect die register, even after millions of hits.

What's more, cleaning and lubrication are a matter of minutes with this unique die set: You just loosen the self-locking set screw, drop the bearing retainer, clean it, reposition it and tighten the screw again. Light bearing oil is all that's needed.

In short, with the Bliss ball bearing die set you get maximum die life—"cleaner" parts—fewer die breakdowns. For further information, write E. W. Bliss Company, Die Supply Division, 1400 Brookpark Road, Cleveland, Ohio. We'll be glad to send you an illustrated technical bulletin that will tell you how you can have ball bearing die sets at a surprisingly low cost or how you can convert your existing die sets to the new Bliss-Dieco design.

dieco DIE SETS

E. W. BLISS COMPANY
DIE SUPPLY DIVISION
Cleveland, Ohio

UNISORB "200" LEVEL-RITE MACHINE MOUNT

BUILT-IN VIBRATION CONTROL AND PRECISION LEVELING

Now . . . simple, fast and secure mounting — plus vibration control — for all types of light machinery and equipment with the new all-purpose UNISORB LEVEL-RITE® "200" MOUNT.

Look at these "200" features . . .

- Fast, simplified and precise leveling
- Free-floating screw post, compensates for uneven or pitched floors
- Safe, sure grip. Can be cemented if needed. No damage to floors, no bolting or lagging
- Exceptional vibration control — stops up to 85% of transmitted vibration
- Lowers noise level, reduces worker fatigue
- Machine can be moved at any time

Try this modern Unisorb Level-Rite "200" Mount now! Handles loadings up to 200 pounds per unit. Send for quantity prices and order form today.

UNISORB 200 SOUTH STREET BOSTON 11, MASS.

Division of The FELTERS Company

Want more information? Send for set of Unisorb "Facts" Books!

Please send me Unisorb Information Bulletin

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City ..... Zone ... State .....

FE9-21

Field Report . . .

sales development programs. Facility is scheduled for completion by fall of 1960.

Detroit Harvester Changes Name

Detroit Harvester Co. now a multi-line manufacturer of automotive, industrial, agricultural, and consumer products, has changed its name to Dura Corp. With less than 10% of its current output in farm machinery, and plants in five states, the old name just didn't seem to make sense. Company has carried on a wide-spread search for a new name for the past three years, finally found it in its own backyard. It had acquired the Dura Co of Toledo, a manufacturer of automotive parts and equipment in 1936, has since operated it as the Dura Division. DH decided it likes the name well enough to answer to it.

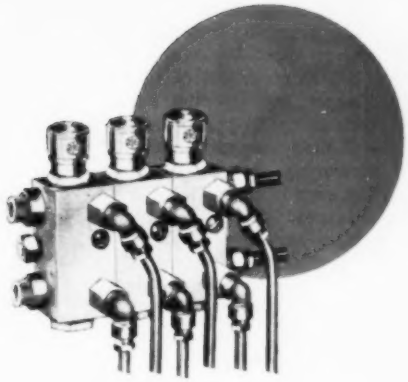
Man-Made Diamond . . .

. . . abrasive products are now available, wheel for wheel, at the same price as natural diamond products, according to Carborundum Co, first to fabricate GE's man-made diamonds into abrasive wheels. Company reports that the first phase of engineering, manufacturing, and marketing of these products is past; they've been perfected as a standard line.

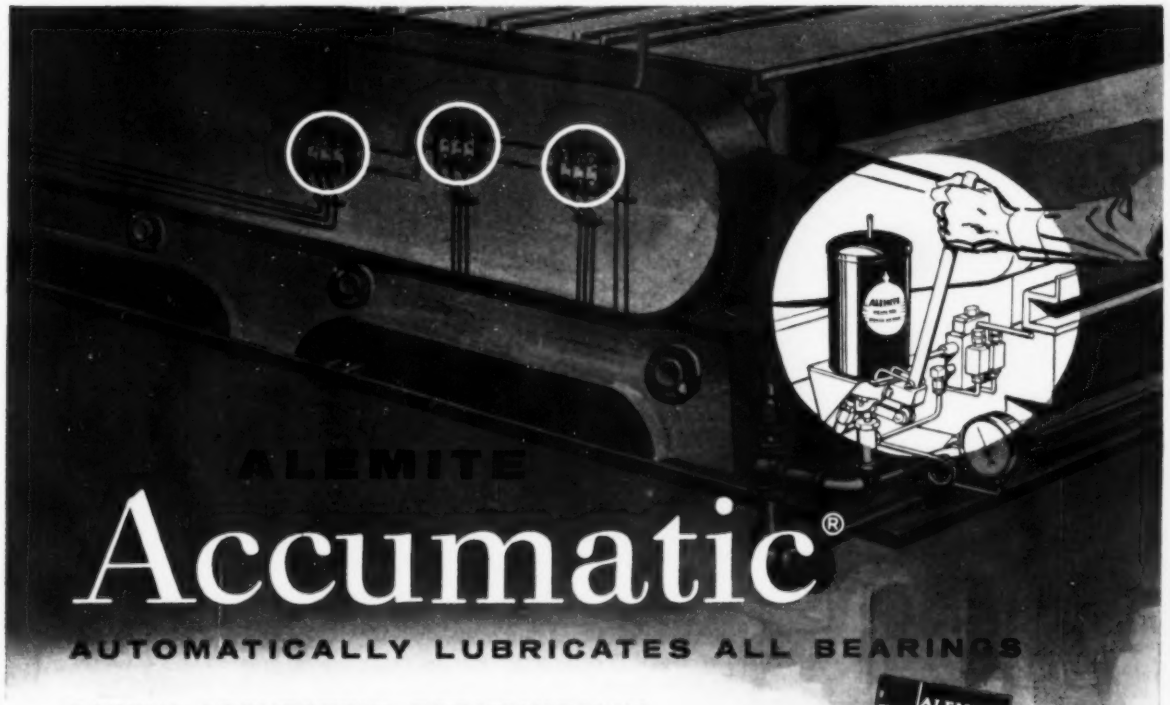
Beryllium Corp Completes Major Fabrication Expansion

Berylco's new plant capacity at its metal fabrication division at Hazleton, Penna, now provides for three separate vacuum hot press furnace

"Good news, Harris! We're going to let you work for another company."



Type II Accumatic Valves are fully automatic. Completely sealed for *clean* lubrication of power shovels, cement kilns, conveyors – any indoor or outdoor installation. For all fluid oils and most lighter greases. Available in four sizes to fit a wide range of applications.



SAFELY, ACCURATELY, ECONOMICALLY

An Accumatic Centralized Lubrication System delivers measured amounts of lubricants at proper intervals, to provide a better lubricant film on all bearing surfaces. Assures completely accurate lubrication, *even while machine is in operation*, with no interruption in production. Reduces lubricant consumption and prolongs service life of each bearing. Machines with many bearings or dangerously located bearings are lubricated from one central point . . . vital high-precision machines receive proper lubrication at all times.

Write for Accumatic catalog today!

Symbol of SW Excellence

ALEMITE
DIVISION
STEWART-WARNER
CORPORATION

Dept. F-89, 1850 Diversey Parkway, Chicago 14, Illinois

Field Report . . .

installations that'll permit production of beryllium metal components in sizes from 6 in. dia up to approx 45 in. dia by 60 in. in length. In addition to press and furnace installations, sizeable increases have been made in powder-making equipment, plus a variety of machine tools for rough machining of components.

Company has been operating both pilot plant and small commercial facilities for production of beryllium parts utilizing powder metallurgical techniques for the past year. Current expansion marks the first major entry of the firm into the commercial beryllium metal fabricating business.

Need an Hour's Computing?

Computers by the hour will be available to business across the nation next year. IBM, in a break-away from its traditional monthly leasing policy for data processing equipment, will set up 25 to 30 Datacenters in major cities including a Wall St center in New York next March, a Chicago unit in April, and a Los Angeles facility in May. Metropolitan Datacenters will each house a million dollar IBM 7070, the most advanced transistorized commercial data processing system to be developed. They'll be open to all businesses regardless of whether they've been IBM customers in the past. Customers may buy as little as 15 hours of computing time a month.

Tennessee Eastman Co . . .

. . . has launched the state of Tennessee's largest single industrial expansion, a new $60-million plant at Kingsport for the manufacture of Kodel, a new Eastman fiber used in wash-and-wear garments. Production is scheduled to start by mid-1960 with an initial employment of 2000; figure will reach 8000 by the time construction is completed. A division of Eastman Kodak, company started a small lumbering and distillation plant in Kingsport in 1920. Today it's the state's largest single employer with gross sales exceeding $100 million annually. Chief products are cellulose, acetate, plastics, dies, paint solvents, and other chemicals.

"I took the liberty of moving your tool box a little—you'll find it outside the factory."

NY Ship Gets Big Order

New York Shipbuilding Corp, Camden, NJ, has a Navy contract to build three destroyers to be armed with guided missiles. Cost of the ships, estimated at $100 million, brings backlog of orders at the Delaware Valley yard to a total of just under $300 million, and insures continued employment of a peacetime record of 10,800 at Camden.

Vlier Buys West Point Mfg Co

Vlier Engineering Corp, Los Angeles, has purchased West Point, Detroit, for an undisclosed amount of cash, will operate it as the Wespo Division of Vlier. Acquisition brings together two of the leading manufacturers of expendable tooling accessories for the metalworking industry.

Additional 1000 Freight Cars . . .

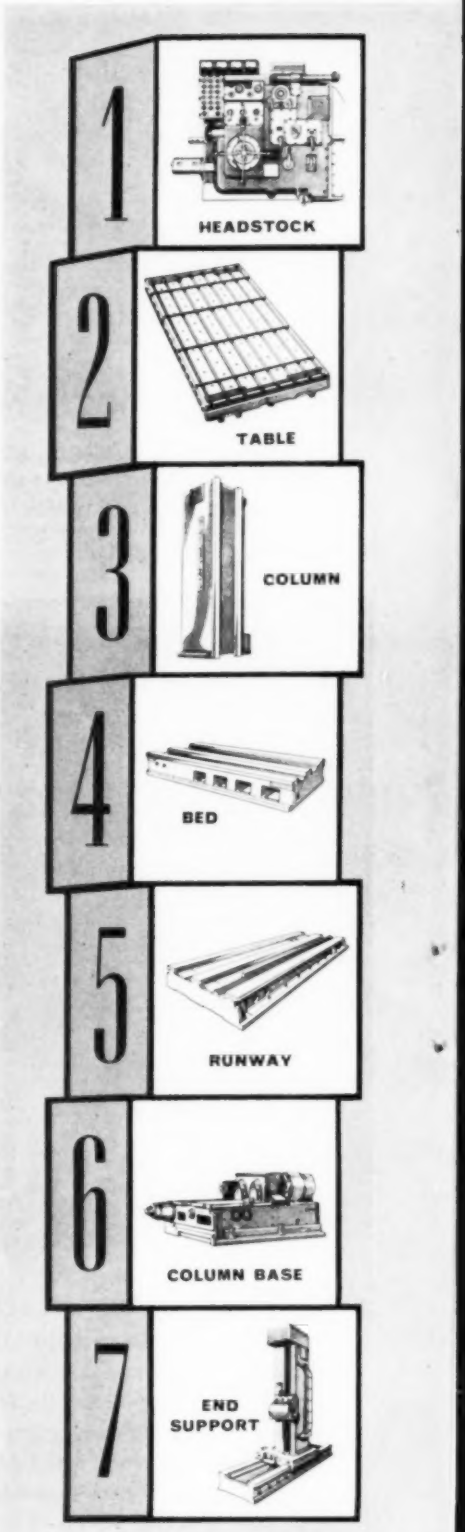
. . . have been ordered by Atlantic Coast Line RR from ACF Industries, American Car & Foundry division. Contract brings to 1200 the number of cars added by ACL in the last four months. Order includes 700 fifty-foot box cars and 300 seventy-ton wet rock phosphate hopper cars to be used for hauling rock from mines in Fla.

GE is Transferring . . .

. . . its resistance welding control business from Waynesboro, Va. to Detroit. Company's Service Shops Dept there will engineer, manufacture, and market all GE controls for resistance welding applications and will handle renewal parts and repair.

Ampex Corp's . . .

. . . newly formed Computer Products Organization, set up within the company's Instrumentation Division, has rounded up $2.7 million worth of business during the first month of its existence. National Cash Register Co has placed a $2 million order for FR-300 digital tape handlers, and General Electric has contracted for



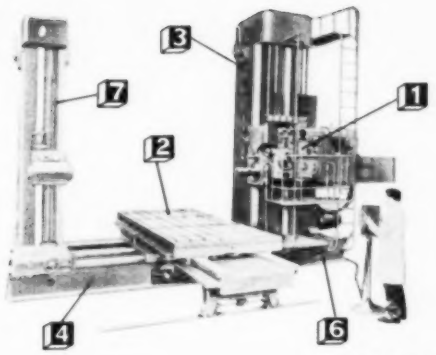
symbol for
machining cost reduction

GIDDINGS & LEWIS

GLF-112

CIRCLE 241 READER SERVICE CARD

GIDDINGS & LEWIS
T. M.



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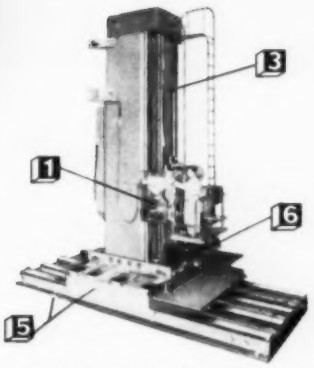
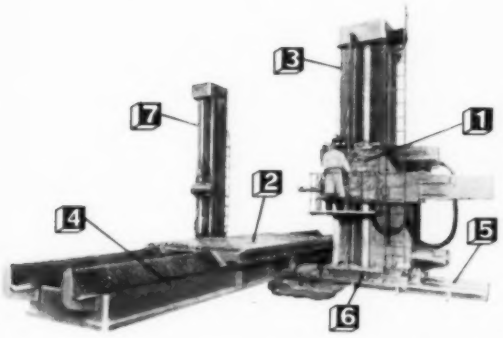
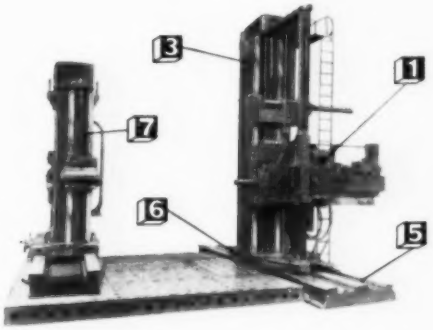


FLOOR TYPE WITH CROSS SLIDING COLUMN



PLANER TYPE



FLOOR TYPE

G&L building-block principle cuts cost... gives you more for your money

When you order a Giddings & Lewis horizontal, you get a machine custom-built to your requirements at the price of a standard machine because it will be built up of interchangeable building-block units.

This building-block concept has long been used by G&L to reduce manufacturing costs and to make possible extra features and extra quality at competitive prices.

There is an almost unlimited variety of arrangements possible with standard components. This, together with the most complete line of attachments and accessories available, enables you to specify the machine that best suits your requirements without paying the price penalty normally associated with custom-built equipment.

Every Giddings & Lewis horizontal is an extremely rugged and precise instrument for removing metal. Heavy-duty construction with generous safety factors enables G&L machines to take on the really tough jobs, while at the same time delivering toolroom capabilities and accuracy — all at the price of a standard production machine.

For horizontals "designed" to your shop requirements — for machines with the versatility, accuracy, and ease of operation that spell greater production and profits — consult your local Giddings & Lewis distributor or write today.

• • •

World's most complete and versatile line of horizontal boring, drilling, and milling machines.

GIDDINGS & LEWIS MACHINE TOOL COMPANY · Fond du Lac, Wisconsin

Giddings & Lewis manufactures: vertical and horizontal boring machines, vertical turret lathes, planers, planer mills, contour milling machines, die sinking machines, drilling machines, numerical and tracer control systems, boring tools and related items, and machine tool accessories.

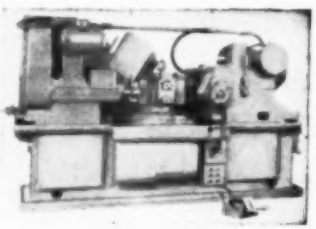
CIRCLE 242 READER SERVICE CARD

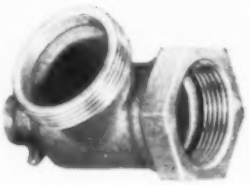
...and parts are finished without rehandling on

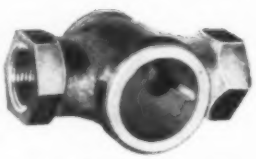
GOSS & DeLEEUW AUTOMATIC CHUCKING MACHINES

The Goss & DeLeeuw "One-Two-Three" Chucker differs from the conventional machine in that it provides the means of machining more than one end of a piece in a single handling instead of requiring several handlings and set-ups. A worthwhile gain in production time is assured.

In the "1-2-3", work is gripped in chuck and all ends machined either in sequence or simultaneously. Goss & DeLeeuw and only Goss & DeLeeuw offers this feature in a standard chucking machine.







A few typical parts finished on this machine are shown here. Write for detailed description . . . send samples of your work for time and cost estimates.

GOSS & DeLEEUW PRODUCT-QUALITY

GOSS and DE LEEUW
MACHINE COMPANY, KENSINGTON, CONN., U.S.A.

Field Report . . .

$750,000 worth of FR-400 handlers. NCR will use the devices in conjunction with its 304 computer system; GE will use the handlers with its 100 computer now under construction. Computer Products, like Ampex, is located in Redwood City, Calif.

PanAm Buys $60 Million Propjets

Pan American World Airways has ordered 12 Lockheed Super Hercules 207 airfreighters to cost $60 million. Fleet will be delivered to the airline beginning in early 1962. The four-engine aircraft will weigh 115 tons and have a payload capacity of more than 38 tons. Plane is expected to have four times the work capacity of PanAm's largest piston-engine cargo transport.

Lockheed Acquiring Stavid

Lockheed Aircraft Corp, Burbank, Calif, will assume full ownership of the assets and business of Stavid Engineering, Inc, Plainfield, NJ. Company is involved in research and engineering in electronics systems, missile technology, and instrumentation. Facilities will continue under the present management, and the Stavid name is to be preserved. Its stockholders will vote on the agreement Aug 17.

Hevi-Duty Adds to Oven Line

Hevi-Duty Electric Co, Milwaukee manufacturer of heat treating and melting furnaces, has bought the Sermax Corp (same city), producer

"We can't let Hollis go. He makes the only decent cup of coffee in the plant."

The X-ray fluorescence analyzer, one of the many modern instruments in the chemical laboratory, helps Jessop make certain you get the specified per cent of each alloy in your specialty steel.

"How X-rays help Jessop give you exactly what you want in alloy steels . . ."

—C. M. Carlisle, Director of Analytical Chemistry

"What's happening here? As the stylus in the X-ray fluorescence analyzer draws red lines on the graph, the Jessop chemist determines the exact per cent of each alloy in a sample of specialty steel.

"Based on this analysis, the melter may ask for the addition of, say, molybdenum to the molten steel now in electric arc furnace No. 3.

"How's it done? Bombarded by X-rays, the alloys in the sample of steel are radiating secondary rays. Converted into electrical energy, the rays are causing the stylus to move and draw red lines on the graph . . . indicating the types and per cent of alloys in the steel sample."

In the Jessop chemical laboratory, the X-ray fluorescence analyzer and many other modern instruments help us make certain you get the exact chemical composition specified in your order. This chemical laboratory is one more reason for your confidence in ordering specialty steels from Jessop. *Specify Jessop . . . and then relax!*

VMA 6720

JESSOP
STEEL COMPANY
Washington, Pennsylvania

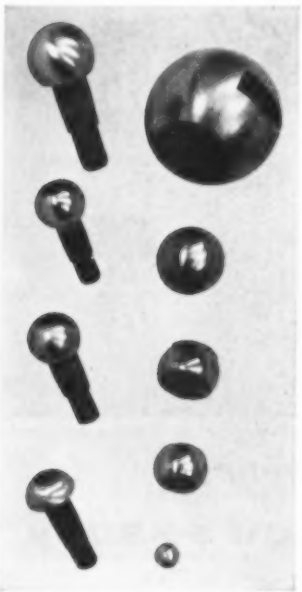
Subsidiary Companies:
Green River Steel Corporation, Owensboro, Kentucky • Jessop Steel International Corporation, New York City
Jessop Steel of Canada, Ltd., Wallaceburg, Ontario • Steel Warehousing Corporation, Chicago, Ill.

Stainless, alloy, tool, cast-to-shape, and forging steels, precision ground flat stock, and other specialty steels

CIRCLE 244 READER SERVICE CARD

WHY PROCESSING TRUNCATED SPHERES BY MICROMATIC METHOD IS FASTER, ECONOMICAL AND MORE ACCURATE

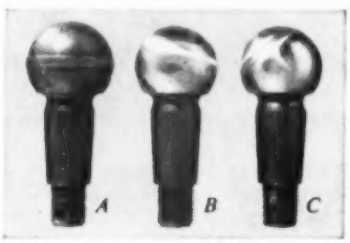
Machining of accurate truncated spheres has long been a design and production problem. The root of the problem lies in the fact that as a single point tool generates a spherical surface, the surface speed varies widely. To eliminate this problem, Micromatic has developed a fast, two-operation technique that assures uniform surface speed when machining any type of truncated sphere.



The above ball studs and other truncated spheres are typical of parts that can be processed faster, to closer tolerances and at lower cost with Micromatic machines and tooling.

First, a special cutting tool removes the bulk of excess stock from the forged part. For instance, here are the results obtained by a major automotive manufacturer: on a 1¼" diameter ball stud, approximately .060" of stock is removed from the ball in a 15-second floor-to-floor cycle. A finish of 40-60 microinches rms is obtained, total error in sphericity is held to .0005" and size is controlled within .001".

Microhoning is the second operation. In a 24-second floor-to-floor cycle, it removes final .002" of stock from the ball to generate required size, a finish of 6-10 microinches rms, sphericity within .0003" and a functional cross-hatch lay pattern.



Typical ball stud processing—(A) heat-treated forging, (B) after Micromatic cutting tool operation, (C) finished ball stud after Microhoning.

See facing page for further details on how Micromatic processing of truncated spherical surfaces secures the above results.

MICROMATIC HONE CORP.
8100 SCHOOLCRAFT AVENUE • DETROIT 38, MICHIGAN

Field Report . . .

of ovens and special equipment. Last September Hevi-Duty purchased the Stroman Furnace & Engineering Co (industrial ovens) from Peterson Oven Co.

Japanese Firm Has Jeep Order

Mitsubishi Heavy-Industries Reorganized, Ltd, a Japanese licensee of Willys-Overland Export Corp, has a $6 million-plus contract for 4341 quarter-ton Jeep vehicles. Order has been placed by the US Army Procurement Agency in Japan; delivery of the Jeeps, which are for service with the Southeast Asia Treaty Organization, will be completed next June.

Paris Mfg Co Adds On

Paris Manufacturing Co, Paris, Tenn, subsidiary of Holley Carburetor Co, Detroit, is set to add new offices, cafeteria, toolroom and machine repair department to its facilities. Company will have a working force of 1050 by fall.

LeCount Tool Works . . .

. . . of West Hartford, Conn, will distribute nationally the Grimes Hand Tapper, made by Grimes Engineering Corp, Cheshire, Conn. LeCount will handle the product through its representatives throughout the US and Canada.

Fruehauf Reopening in Tenn

Fruehauf Trailer Co's plant in Memphis, which has been closed since February of last year, is reopening this month. It's being completely retooled for production of the firm's latest model truck trailers, and will employ 400 initially.

"I'm new here. Who do I see about a raise?"

Free Literature

To order any of these bulletins, circle corresponding number inside back cover.

MACHINES AND ATTACHMENTS

1 AUTOMATIC PRODUCTION LATHES—*Gisholt Machine Co, 1245 E Washington Ave, Madison 10, Wis.* 26-page catalog (form 1213) illustrates and describes features of Masterline Models 12, 12V, and 24, heavy-duty hydraulic units for either continuous operation on one job in a mass production plant, or for a wide variety of parts produced in small lots. 25 job applications pictured and discussed; accessories, floor plans, specifications.

2 AUTOMATIC PRODUCTION PRESSES — *Minster Machine Co, Minster, Ohio.* 12-page bulletin contains information on how many types of Minster open back gap presses both fixed base and inclinable, as well as a full line of straight-side presses, can be equipped with various feed mechanisms for efficient automatic production. Advantages discussed as applied to the metal stamping industry, plus installation photos of six operations.

3 HYDRAULIC BENCH ARBOR PRESS—*K R Wilson, Inc, Arcade, NY.* Bulletin 104-AO covers new 10-ton hand-operated air-oil unit. Suggested work applications illustrated. Air-actuated, fast ram approach feature which permits speeds up to 20 spm is described. Specifications and prices included.

4 CUTOFF SAW—*Production Machinery Inc, PO Box 322, Oakton Station, Des Plaines, Ill.* 5-page bulletin pictures and describes the Promacut, a multi-purpoes unit that cuts all shapes of carbon steel, stainless, and alloy including angles, channels, I-beams, tubes, bars, plates, and profiles. Unit operates without clamping or hold-down, requires no coolants.

5 HORN PRESSES—*Federal Machine & Welder Co, Warren, Ohio.* 12-page bulletin 52170A contains illustrated information on Warco line in capacities from 50 to 200 tons.

TOOLS AND ACCESSORIES

6 MECHANICAL TOOLHOLDERS—*Firth Sterling Inc, 3113 Forbes Ave, Pittsburgh 30, Penna.* 18-page catalog MTI-5 covers new line of Firthite holders and throw-away inserts. Tables list toolholder numbers and dimensions, and recommended standard inserts; data on inserts includes styles, specifications, stocked grades.

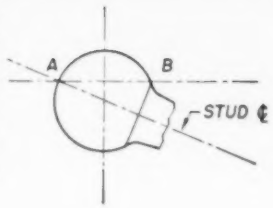
7 AIR GAGES—*Federal Products Corp, 1144 Eddy St, Providence 1, RI.* 32-page catalog 59D describes the Dimensionair one master air gage system and provides specifications on two new air gage models (10,000:1 and 20,000:1 magnification). Includes details on variety of attachments and accessories, and instructions on how to apportion gaging ranges to suit tolerances; applications illustrated and described. Section covers use of Dimensionair system in automation gages.

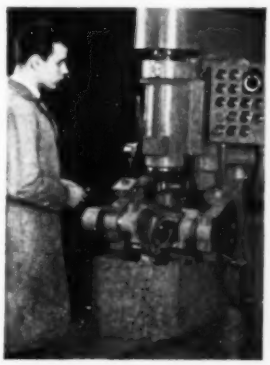
8 RUBBER-BONDED ABRASIVES—*Carborundum Co, Niagara Falls, NY.* 6-page illustrated folder provides information on products for polishing and finishing including rubber-bonded polishing wheels, unfinished sticks and stones, special purpose stones, and wheel dressers and sticks. Discusses specific functions, and types of materials on which they are particularly useful; specifications and prices.

9 COMPOSITE TOOL STEEL DIE BLANKS—*Simonds Worden White Co, 1101 Negley Place, Dayton 7, Ohio.* Bulletin describes and pictures four new types of blanks for manufacturing piercing, blanking, and forming dies. They are

HOW PROCESSING TRUNCATED SPHERES BY MICROMATIC METHOD ASSURES ECONOMY, SPEED AND ACCURACY

As an example, here's how Micromatic equipment in two fast operations machines 1¼" diameter forged ball studs. For both operations, the ball stud is located on the taper, clamped in the thread and positioned on an inclined axis. Thus the center of the ball crown (A) and the intersecting point of sphere and shoulder (B) are in a horizontal plane.

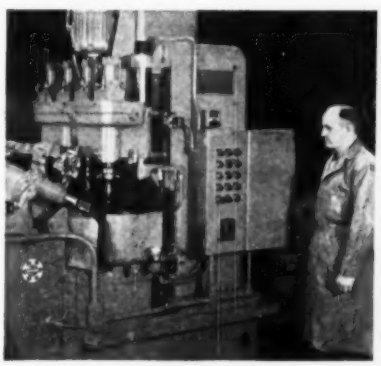




FIRST OPERATION: *Cutting excess stock from forged ball stud.*

The first machining of ball stud is a cutting operation. A special Micromatic cutting tool, that is U-shaped at the cutting end, is used to assure constant cutting speed over every point of the ball. Two round carboloy blades are clamped in the tool—clamp also acts as a chip breaker. With blades positioned in a counterbore, no adjustments are required. Size is controlled within .001" by depth of feed, set by an adjustable stop. Blades may be turned or reversed to give several usable cutting faces. Also, since they are throw-aways, these blades offer additional economies. Approximately 2,000 balls are machined with each set of blades. In a 15-second floor-to-floor cycle, the cutting operation is completed—total error in sphericity is held to .0005".

The ball is then Microhoned. The combination or rotating motions of workpiece and the special Microhoning tool results in a functional cross-hatch lay pattern and makes the abrasive self-dressing. In a 24-second floor-to-floor cycle, Microhoning generates required size, sphericity within .0003" and a finish of 6-10 microinches rms.



SECOND OPERATION: *Microhoning ball stud to secure final size, sphericity and finish. Single spindle machines also available.*

For Further Information, Write To:

MICROMATIC HONE CORP.
8100 SCHOOLCRAFT AVENUE · DETROIT 38, MICHIGAN

ALLEN

The cost of ALLEN Hex-Socket Cap Screws is only a minor fraction of your assembly costs . . . be sure you're getting the timesaving, cost-saving advantages of genuine Allens!

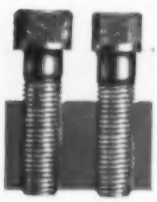
Ever since Allen first produced the hex socket head screw nearly fifty years ago, specifying *genuine* Allens (made by Allen of Hartford) has been a sure way to guarantee dependable threaded fastening.

Only *genuine* Allens have Leader Points that make starting easier, and greatly minimize danger of cross threading. *Genuine* Allens are "pressur-formd" to preserve the long fibers uncut throughout the length of the screw, giving stronger sockets for greater tightening torque.

Write for samples and engineering data. See how *genuine* Allens will make your product better.

ALLEN HEAD
HEX-SOCKET SCREWS

Allen's new 1960 Series Socket Head Cap Screws give up to 2½ times more load carrying capacity, without indentation. Head diameter of sizes from ¼" up is now uniformly 1½ times the body diameter—providing more under-the-head bearing surface, and a proportionate increase in clamping force. Write for new Bulletin G-25, with full specifications.



Stocked and sold by leading Industrial Distributors everywhere

ALLEN MANUFACTURING COMPANY
Hartford 1, Connecticut

Free Literature

To order any of these bulletins, circle corresponding number inside back cover.

supplied with any of four standard tool steel laminates welded or forged to back-up plates of SAE 1008 low carbon steel. Lengths up to 120 in. are available.

10 MINIATURE TEMPERATURE CONTROLS—*Fenwal Inc, Pleasant St, Ashland, Mass.* 4-page brochure MC-182 covers 19 different midget and miniature Thermoswitch controls. Dimensions, temperature range, electrical ratings, and available modifications given for each unit. Data given on new hermetically sealed Model 32411 which has contacts set to open on temperature rise.

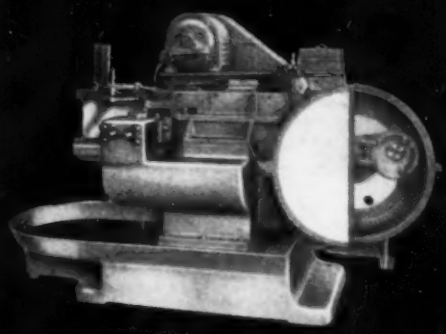
11 BORESCOPES — *Lenox Instrument Co, 2012 Chancellor St, Philadelphia 3, Penna.* Bulletin illustrates and describes two types developed to meet extremely difficult inspection problems encountered in aircraft production; they are designed to permit speedy internal visual examination of critical, inaccessible assemblies. Both types have viewing head that can be revolved in the hole, and a battery-powered lamp.

12 MARKING EQUIPMENT—*Markem Machine Co, 150 Congress St, Keene 45, NH.* 12-page catalog describes methods and equipment for marking of all types of electrical and electronic products. Product index, ranging from wire lead components to panels and chassis, simplifies selection of best method. Units range from high production machines with marking speeds up to 8000 pieces per hr to the compact, hand-operated "Companion."

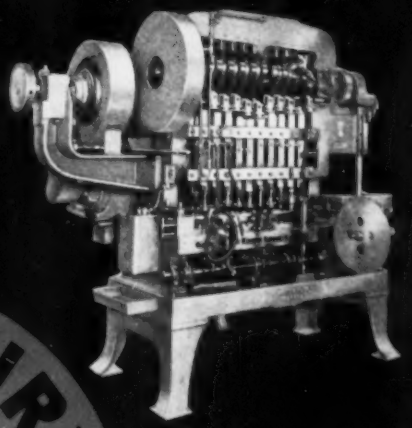
13 RUBBER CONTACT WHEELS—*Chicago Rubber Co, 651 Market St, Waukegan, Ill.* 16-page technical data book gives detailed information on selection, application, and operation of Cosmo-Rubber contact back-up wheels for abrasive belt grinding and finishing. Variety of types illustrated and discussed. Section on industrial rollers included.

14 PHYSICAL TESTING EQUIPMENT —*Custom Scientific Instruments, Inc, 541 Devon St, Kearny, NJ.* 16-page catalog 59A contains illustrations and brief descriptions of 73 testers or equipment manufactured as standard products. Includes abrasion testers; flammability-ig-

"Of course, it's merely a suggestion, George, but don't forget who's making it!"



EYELET, SLITTER
& WIRE
MACHINERY

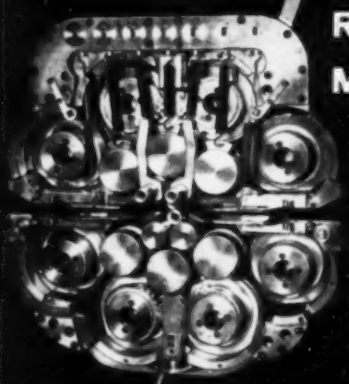


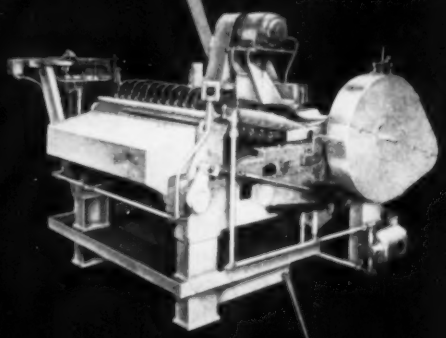
COLD HEADING
MACHINERY

WATERBURY
MACHINERY BUILDERS
FARREL

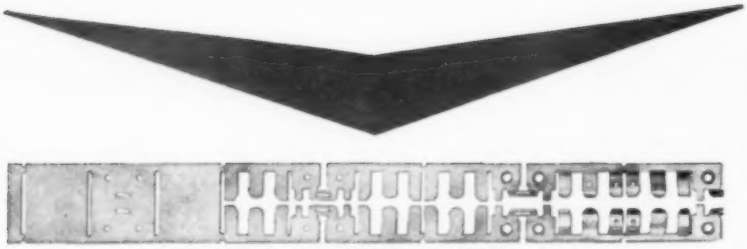
POWER
PRESSES

ROLLING MILL
MACHINERY





THE WATERBURY FARREL FOUNDRY & MACHINE CO.
DIVISION OF TEXTRON INC.
Waterbury, Connecticut, U.S.A.
Sales Offices: Chicago • Cleveland • Los Angeles • Millburn, N. J.



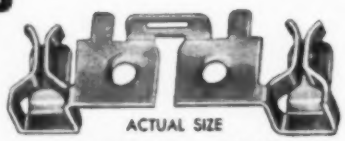
Blanking, Piercing and Preforming in Press

NILSON 4-SLIDE

BLANKS *and* FORMS IN ONE CYCLE!

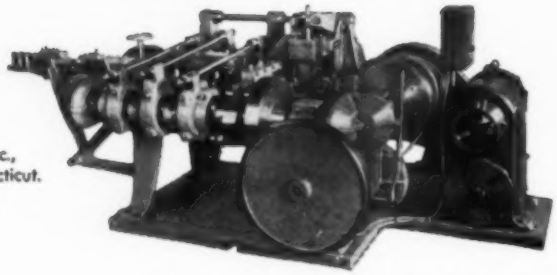
Cutoff

Partial Forming with Slides



ACTUAL SIZE

Final Forming with Slides



MANUFACTURER:
Harvey Hubbell, Inc.,
Bridgeport, Connecticut.

PRODUCT:
Contact Spring.

PRODUCTION:
136 Parts Per Minute.

Nilson 4-Slide Machine with Built-in Press

Harvey Hubbell shifted production of this part from a conventional press and progressive dies to a Nilson 4-Slide with built-in press. The immediate results: elimination of two secondary operations . . . simpler die . . . higher production rate . . . no stripping problems.

Harvey Hubbell also found that vertical mounting of die makes replacement easy . . . permits automatic disposal of scrap by gravity. And maintenance costs are incredibly low—this machine has been operating for twelve years without major repairs!

Nilson builds 7 models of ribbon metal forming machines, with built-in press sections ranging from 5 to 75 tons capacity. One of these machines may help you bring your stamping methods up-to-date!

Write today for the Nilson General Catalog on Automatic 4-Slide Equipment.

NILSON
THE A. H. NILSON MACHINE CO.
601 Bridgeport Avenue • Shelton, Conn.

AUTOMATIC WIRE & RIBBON METAL FORMING 4-SLIDE MACHINES • WIRE & STOCK REELS • WIRE STRAIGHTENING EQUIPMENT • AUTOMATIC STAPLE FORMING MACHINES • SPECIAL WIRE FORMING EQUIPMENT

Free Literature

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nition testers; production, control, and research equipment; thermal conductivity-dielectric units; and thickness, compression, and recovery gages.

HEAT TREATING AND WELDING

● CARBON DIOXIDE WELDING—*Hobart Brothers Co, EW-208, Troy, Ohio.* 38-page booklet presents information on Migarc (metal-inert-gas-shielded-arc process) welding of mild steel and low alloy steels with carbon dioxide (CO_2) shielding gas. Describes process, equipment and power sources, welding costs, deposition rates, welding preparation and positioning, welding factors; includes tables and charts, illustrated applications. Request direct on company letterhead.

15 SHAPE CUTTING MACHINE — *Linde Co, Div of Union Carbide Corp, 420 Lexington Ave, New York 17, NY.* 8-page bulletin F-1294 offers illustrated data on the Oxweld CM-60 that can automatically reproduce metal parts from exact size drawings. Unit can flame-cut intricate parts of any length, width, or thickness. Standard models may be equipped with 10 torches to cut widths of 10 ft; larger models can cut shapes of any width. Thickness of metal that can be cut is limited only by capacity of torches used.

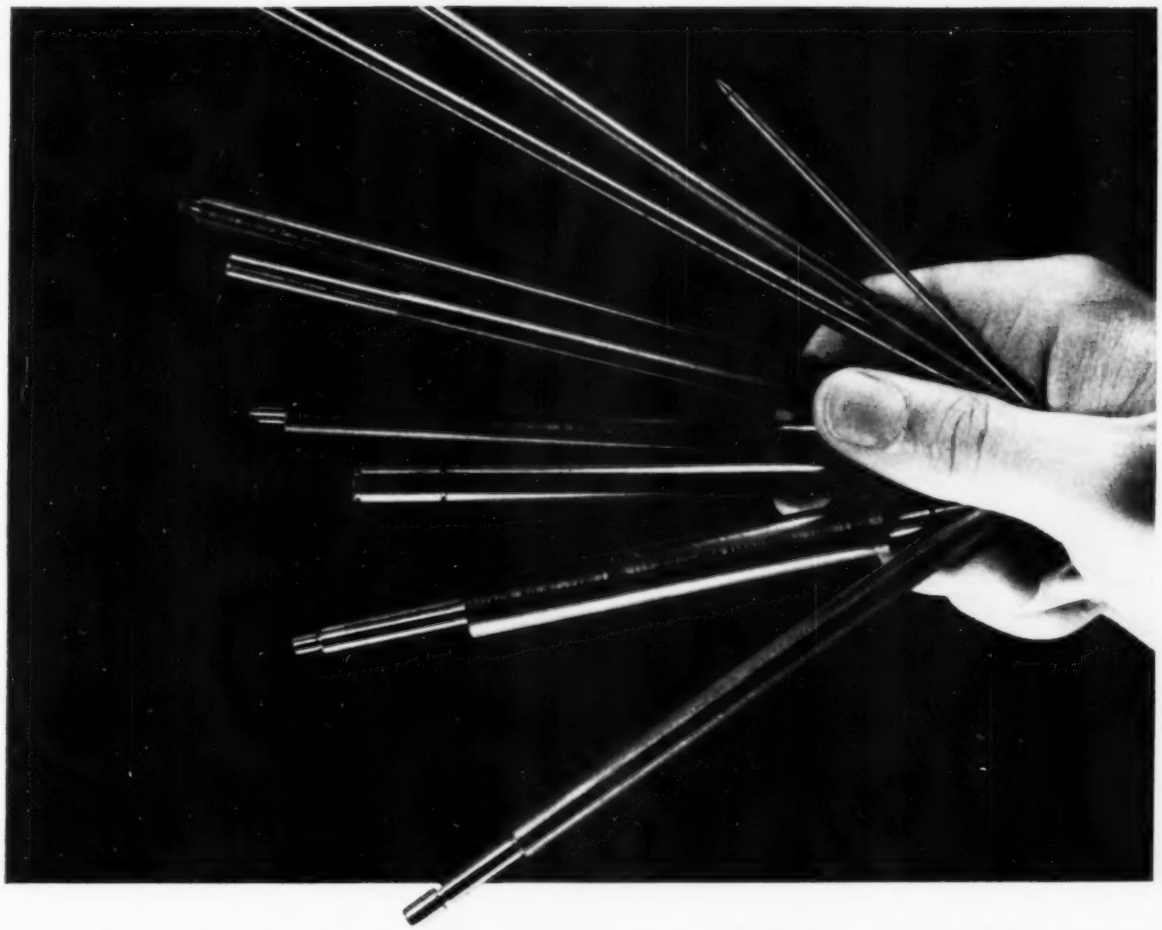
16 WELDS SHAVER—*Zephyr Manufacturing Co, 201 Hindry Ave, Inglewood, Calif.* 4-page catalog 17 details operating features of shaver for cutting and finishing weld beads to within 0.001 in. of surface plane. Describes models for finishing of aluminum and other soft alloy weldments, and for titanium, stainless steel, and hard alloy weld beads. Cutters for various applications listed.

17 PACKAGED TEMPERATURE CHAMBER—*Missimers Inc, 3737 San Fernando Rd, Glendale 4, Calif.* Bulletin describes Model FT1 bench unit that can be moved about for Mil Spec temperature testing anywhere within a lab or on a production line. Temperatures are from —100 to 350 F.

PLANT SERVICE EQUIPMENT

18 LIQUID SPRAY BUFFING — *Lea Manufacturing Co, 16 Cherry Ave, Waterbury 20, Conn.* 16-page manual contains data on setup and operating procedures for automatic buffing, burring, and

"Quit kidding my new man; you know we don't carry hex nuts that big."



Which will inspect these shafts faster... mechanical or optical gaging?

Over 25 different metal shafts go into the calculators made by Monroe Calculating Machine Company.

In the past, inspection of these shafts required the use of a large number of "go" and "no-go" gages. Rate? *About 7 per minute.* In addition, gage surveillance was both time-consuming and expensive.

Then the switch was made to optical gaging, using a Kodak Contour Projector. The method is simple: A master shaft is positioned to either upper or lower tolerance limits on the screen. Then the part to be inspected is placed in the same position.

Rate with optical gaging? *About 17 per minute!* And, there's no longer a need to send gages back to the crib for resetting. One Kodak Contour Projector does the whole job.

Besides saving time, optical gaging with a Kodak Contour Projector offers you a chance to *cut* down on gage costs, use operators with little or no training, and often obtain accuracy *not* possible by other means.

Where can you use optical gaging? Almost *anywhere* in the plant—receiving, assembly, production, final inspection, toolroom.

Facts about Kodak Contour Projectors are spelled out in a brochure which you can get by writing to the address below. After you've had a chance to look over the contents of the book, we'd like to demonstrate *why* and *how* one of the six Kodak models will best fit your inspection needs.

Use of low-cost Model 8 Kodak Contour Projectors enabled the Monroe Calculating Machine Co., a division of Litton Industries, to more than double inspection rates.

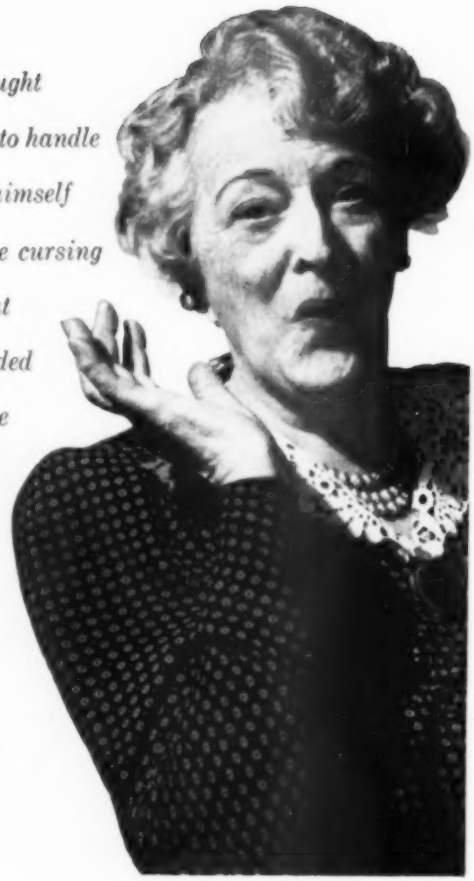
Special Products Sales

EASTMAN KODAK COMPANY, Rochester 4, N. Y.

the KODAK CONTOUR PROJECTOR

Kodak
TRADE MARK

I'm being courted again...



You'd have thought Herbert actually had to handle those dirty old gears himself the way he'd come home cursing and mumbling about "rejects" and "added costs". But this is the third night this week he's taken me out for dinner! I'd certainly like to meet that CINCINNATI person!

Whether it's custom gears or custom gear boxes, you'll be pleased with CINCINNATI quality, price and delivery. Shaved gears to 39" diameter, tooth grinding capacity to 25". Write for brochure.

CINTI

THE CINCINNATI GEAR CO.

Wooster Pike and Mariemont Ave. Cincinnati 27, Ohio
Custom Gear Makers Since 1907

GEARS, good gears only

Free Literature

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polishing. Information includes material on recommended abrasive grades, drawings of typical layouts, and a section on suggested equipment.

19 SAFETY PRODUCTS — *Bausch & Lomb Optical Co, Rochester 2, NY.* 10-page catalog A-1762 contains illustrated descriptions of plastic, metal, and combination safety glasses, specially designed goggles, and eye shields, and specifications for Bal-Safe lenses and the new Enduron plastic lenses. Information included on B&L vision testing instruments, Quiet Ear protector, and a line of safety eyewear cases, plus indexed price list for all items.

20 INDUSTRIAL TRUCKS — *Hyster Co, PO Box 847, Danville, Ill.* 8-page illustrated condensed guide contains information on units ranging from 1000 to 40,000 lbs capacity for wide range of uses. Includes performance data, dimensions, and equipment specifications. Table lists 43 options, attachments and accessories available on lift trucks, plus specialized handling attachments to outfit a truck for a specific handling job.

21 DESCALING MACHINES — *Pangborn Corp, Hagerstown, Md.* 20-page bulletin 609 describes complete line of Rotoblast units. Photos and diagrams show details and operating features of wheels which provide the cleaning force of the mechanical descaling equipment. Various cabinet designs and material handling features appropriate to type of work being processed are described.

22 METERING PUMPS — *Mechanical Products Corp, 1716 W Hubbard St, Chicago, Ill.* Selection manual and catalog describes Maisch stainless steel units; gives details on application for wide variety of uses. Features include positive displacement, smooth non-pulsating flow, and extreme accuracy under most adverse operating conditions.

23 STEAM-JET CLEANER — *Pantex Manufacturing Corp, Steam Generator Division, PO Box 660, Pawtucket, RI.* Illustrated bulletin SC-500 presents information on the 100 gph Speedysteam Model 100. Illustrated with in-use photos, literature gives designs details and operating advantages of this portable unit with fully automatic ignition, modulated fuel consumption, built-in soap dispenser, anti-siphon valve, and four rubber-tired wheels.

24 STATIONARY AIR COMPRESSOR *Joy Manufacturing Co, Oliver Bldg, Pittsburgh 22, Penna.* 24-page bulletin A-62 describes the WN-112 V-vertical compressor designed for continuous, heavy-duty service for pressures to 125 psi with piston displacements from 468 to 974 cfm. Specifications, diagrams, installation photos included.

PARTS AND MATERIALS

25 VARIABLE SPEED PULLEYS—*T B Wood's Sons Co, Chambersburg, Penna.* 12-page illustrated bulletin 4101 contains description of line designed to eliminate freezing and sticking. Gives technical data for five MS sheaves for ratings of 2, 3, 5, 10, and 15 hp. Power is transmitted from the stationary flange through a removable sleeve cap which is keyed to the moving flange by torsionally resilient rubber keys.

● HYDRAULIC VALVE MANUAL—*Rivett, Inc, Brighton 35, Boston, Mass.* 20-page manual 230 illustrates and describes operation and application of

pressure controlled units. The 3000-psi valve is used for relief, sequence, reducing, unloading and counterbalance in hydraulic circuits providing automation of machine operation. Includes flow diagrams, pressure vs flow curves, ratings, dimensions, drawings, specifications. Request direct on company letterhead.

26 WEAR-RESISTANT ALLOYS — *Haynes Stellite Co, Division of Union Carbide Corp, 420 Lexington Ave, New York 17, NY.* 32-page booklet provides engineering data on a group of 11 cobalt and iron-base alloys. Chemical, physical, and mechanical properties listed in charts and tables. Information on heat treatment, joining, machining, and grinding detailed in separate section.

27 STEEL BAR — *Jones & Laughlin Steel Corp, 3 Gateway Center, Pittsburgh 30, Penna.* 8-page booklet contains information on Jalcase 100, a free machining, stress stabilized cold finished bar steel. Mechanical properties, analysis and machinability rating in tabular form; wear resistance, finish uniformity of hardness, sizes, and heat treatment discussed; applications listed.

28 HARDENED WAYS — *Ohio Knife Co, Dept W-97, Cincinnati 23, Ohio.* 15-page illustrated catalog contains product information and stock specifications for many additional O K standard way and aluminum-bronze way cross-section sizes now available. Data included on flange slides and gibs, and composite die sections.

29 METAL PACKINGS—*Garlock Packing Co, 438 Main St, Palmyra, NY.* 24-page bulletin AD-166 covering packings for pumps, engines, and compressors, contains data for proper selection, application, and installation of product. Information included on pressure temperature and other service requirements relative to the various kinds of metal packing currently available.

30 ROTATING UNIONS—*Deublin Co, 1919 Stanley St, Northbrook, Ill.* 20-page catalog illustrates and describes units for water, steam, air, hydraulic, vacuum and coolant services. Charts, engineering drawings, installation information for all sizes and applications; lubrication instructions included.

31 TEXTURED METALS — *Ardmore Products, Inc, 164 Aldene Rd, Roselle, NJ.* 6-page illustrated booklet describes features and applications of materials available in a variety of finishes.

32 ALUMINUM BRONZE BARS — *Johnson Bronze Co, New Castle, Penna.* 4-page folder outlines advantages of both solid and centrifugally cast cored bars available in standard 12½-in. lengths and in sizes up to 8 in. OD. Information provided on applications in gears, worms, worm wheels, valve seats, guides; physical properties and tolerances.

(continued on p158)

". . . whereas my firm will guarantee him $20,000 to start if you encourge him toward electronics. . ."

BOILER TUBES POWER BRUSHED CLEAN prior to welding. Automatic machine setup inserts end of tube between Osborn brush rolls . . . cleans rotating tube on pre-set time cycle . . . stops and ejects . . . repeats operation.

SOLVED

with OSBORN Power Brushing

Before these boiler tubes can be induction welded—scale and hardened preservative oil must be removed.

This manufacturer does the job simply . . . efficiently with fast, automatic Osborn Power Brushing.

Quality and uniformity of the finished tubes are excellent . . . to help assure strong welds. *Cost is less* than the former blast-cleaning method, and the operation is *cleaner*, too . . . no flying grit.

This is typical of the many new . . . varied—and often unique—metal cleaning and finishing operations being done throughout industry by modern Osborn Power Brushing.

An **O**sborn **B**rushing **A**nalysis—made in your plant now—can *pinpoint new savings* for you, too. Write us for details. *The Osborn Manufacturing Company, Dept. C-88, Cleveland 14, Ohio.*

Osborn Brushes

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POWER, PAINT AND MAINTENANCE BRUSHES
METAL FINISHING MACHINES . . . AND FINISHING METHODS
FOUNDRY PRODUCTION MACHINERY

MOLINE

FOR GREATER PRODUCTION • EFFICIENCY • SAVINGS

Use rugged, reliable "Hole Hog" machine tools for such jobs as:

★ Multi-Spindle Boring ★ Single and Multi-Spindle Honing
★ Straight Line Multi-Drilling ★ Adjustable Spindle Drilling
★ Vertical and Way-Type Fixed Center Drilling, Boring and Tapping
★ Special Multiple Operation Machine Tools

Twenty-Station, Ten-Unit Transfer Machine for boring, counterboring, chamfering and valve clearance operations on V-8 automotive engine blocks. (Shown)

Over 58 years of Machine Tool Engineering experience is at your service. Tell us your particular problem.

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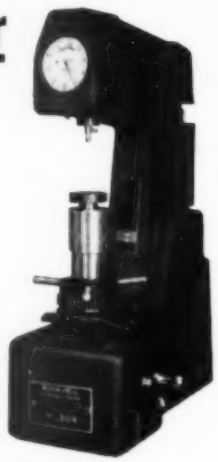
100 20TH STREET • MOLINE, ILLINOIS

REPRESENTATIVES IN PRINCIPAL CITIES

CIRCLE 253 READER SERVICE CARD

One of these Wilson "Rockwell" instruments will do your hardness testing job



No matter what your hardness testing requirements are, there's a Wilson "Rockwell" tester to do the job. Choose from this complete selection of hardness testing equipment:

"Rockwell" Hardness Tester—for most hardness testing functions.

"Rockwell" Superficial Tester—for extremely shallow indentations.

TwinTester—Combines functions of "Rockwell" and "Rockwell" Superficial testers.

Semi and Fully Automatic—for high-speed testing, at rates up to 1,000 pieces per hour. Automatically classifies pieces as CORRECT, TOO HARD, or TOO SOFT.

Special Machines—for testing large objects, internal readings, and other unusual applications.

Diamond "Brale" Penetrators—Flawless diamonds, individually calibrated, and highest quality construction assure perfect testing every time.

Write for Bulletin RT-58

WILSON "ROCKWELL" HARDNESS TESTERS

Wilson Mechanical Instrument Division
American Chain & Cable Company, Inc.
230-8 Park Avenue, New York 17, New York

ACCO

Free Literature

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33 JIC HYDRAULIC & PNEUMATIC SYMBOL REFERENCE CHART—*Republic Manufacturing Co, 15655 Brookpark Rd, Cleveland 35, Ohio.* 8½ x 11 in. chart, punched for hanging, is designed for ready reference to standard symbols, and cross referenced for Republic valves.

34 PLASTIC PARTS — *Raybestos-Manhattan Inc, Equipment Sales Div, Bridgeport, Conn.* 12-page bulletin 200 provides information on physical properties and applications of Pyrotex, an asbestos-reinforced, thermosetting phenolic resin plastic. Features include exceptional dimensional stability, high modulus of elasticity and strength, resistance to chemicals and water. Material, which is laminated and molded, can be machined into precision parts.

35 FORMABLE SANDWICH CORE MATERIAL — *Narmco Resins & Coatings Co, 600 Victoria St, Costa Mesa, Calif.* 12-page bulletin SP-1 describes Multiwave, manufactured out of continuous strips of aluminum foil, crimped into a sine-wave pattern. Second sine-wave is introduced by alternate foil ribbons, resulting in accordian-like construction that accounts for product's formability. Material can be shaped into compound curves without saddles or cripples. Applications include plastic tools and drill fixtures.

36 PHOSPHOR BRONZE — *Riverside-Alloy Metal Division, H K Porter Co, Riverside, NY.* 20-page catalog is handbook on wire, bars, rods, strip, sheets, circles, and special shapes, plus latest information on Flexograin, a fine grain phosphor bronze. Composition, specifications, and properties of the various alloys discussed in chart form.

37 COLD DRAWN STAINLESS STEEL WIRE—*Uddeholm Co of America, 155 E 44th St, New York 17, NY.* 77-page book describes general qualities of 27 different types of ferritic, austenitic, ferritic-austenitic, and martensitic stainless steels available. Includes data on tolerances, mechanical and magnetic properties, available finishes, sizes, forms, and applications.

38 ROLLER BEARINGS — *Orange Roller Bearing Co, 557 Main St, Orange, NJ.* 48-page engineering reference manual M-59 gives construction, dimensions, capacities, housing and tolerance fits for complete line. Included are staggered roller bearings, full type needle bearings, cage type needle bearings (with and without seals), journal roller bearings, cam followers, cam yoke rollers, and thrust roller bearings.

DON'T WASTE DOLLARS

IN MACHINE OUTPUT

TO SAVE PENNIES

IN TOOL LIFE

HERE'S HOW SOME SHOPS HAVE DOUBLED AND TRIPLED THE OUTPUT OF EXPENSIVE MACHINES

	Typical Examples—Same Machines . . . Same Tools . . . Same Workpieces							
	Job No. 1		Job No. 2		Job No. 3		Job No. 4	
	240-Minute Tool Life Setup	25-Minute Tool Life Setup	75-Minute Tool Life Setup	25-Minute Tool Life Setup	120-Minute Tool Life Setup	80-Minute Tool Life Setup	120-Minute Tool Life Setup	22-Minute Tool Life Setup
Machine Cost per Hour	$ 8.00	$ 8.00	$10.00	$10.00	$ 9.00	$ 9.00	$ 9.00	$ 9.00
Tool Cost per Hour	$ .04	$ .40	$ .36	$ .76	$ .14	$ .215	$ .14	$ .77
Cost per 8-Hour Shift	$64.32	$67.20	$82.88	$86.08	$73.12	$73.72	$73.12	$78.16
Pieces per Shift	51	181	8	17	94 hrs./pc.	41 hrs./pc.	8	16
Cost per Piece	**$ 1.26**	**$ .37**	**$10.36**	**$ 5.06**	**$859.16**	**$377.81**	**$ 9.14**	**$ 4.88**
Cost Reduction	70%		51%		56%		47%	

Get the complete story . . . send for the booklet "There's Profit in Retiring a Tradition."

From many machine shops the story is the same—*they are sacrificing low-cost carbide inserts through increased feeds and speeds . . . to achieve startling savings in total-cost-per-piece.* Production increases even greater than 100% have been recorded. The increased tool costs were insignificant by comparison.

Where machines have been operating at less than maximum efficiency, *unit cost can be reduced on many jobs overnight . . .* merely by using modern cutting tools to get full potential machine output . . . instead of operating at fractional machine capacity to gain long tool life.

This idea has been *PROVEN-IN-USE* by many progressive plants. We will gladly send you records of such operations. These results can be duplicated in plants where machines and talented operators have been held back by old ideas about tooling and tooling costs. Ask your Kennametal Carbide Engineer how Kendex* (patented) tooling can help you get more efficient output from your machines . . . or write KENNAMETAL INC., Latrobe, Pennsylvania, for the booklet "There's Profit in Retiring a Tradition."

*Trademark

9-7229

INDUSTRY AND

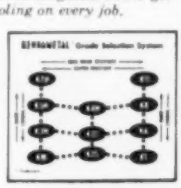
KENNAMETAL

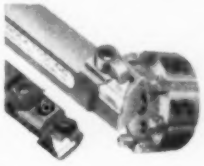
. . . Partners in Progress

TO MULTIPLY YOUR MACHINE OUTPUT . . . YOU NEED 3 THINGS:

The 'Three-Man Tooling Team' that utilizes the specialized knowledge of your Tool Engineer, your Machine Operator, and the Kennametal Carbide Engineer . . . *to get the right tooling on every job.*

The Kennametal complete range of grades that provides the precise properties and uniformity that permits *accurate prediction of tool life.*





Kendex instant insert change without need to reposition the tool. This is the key to this new practice . . . *frequent tool change without excessive down-time.*

MATTISON
HIGH-POWERED PRECISION
GRINDING METHODS

How to stretch belt life polishing stainless to #4 finish

Mattison's diamond-head machine design keeps belts clean and cool at Atlas Steels, Limited

More production per square inch of abrasive belt—that's one of the advantages of Mattison's four-roll head design at Atlas Steels, Limited, Welland, Ontario.

The obvious reason for long belt life is longer belts—more time between cuts for cooling. Another is that these 243-in. long belts undergo four "flexes" instead of two, giving them a better chance to "break loose."

But long belt life is not the only advantage of a four-roll head. Quality is higher, too. For one thing, the belt doesn't "wrap" on the contact roll. A flatter angle of attack permits the belt to conform more closely to the uneven surfaces of the sheet. This produces a better scratch pattern and accounts for the incomparably high finish obtained on many jobs.

Specialization is another factor. In the Mattison head, one roll aligns the belt, one drives it, and another applies the pressure. The fourth is an idler and simply increases flexing action. Separation of the contacting and driving functions means motor pulsations cannot be transferred to the finish.

These features have paid off in higher quantity and easier control of quality at Atlas. Company officials estimate that not *two sheets in a million* are lost due to machine performance. A #4 finish is consistently produced on as many as 150 tons of stainless sheets per month.

Fig. 2—Belt replacement on the 50" machine requires less than five minutes' downtime. Belts are 243" long and range from 50 grit for roughing to 120 and 150 grit for finishing. Plain rubber contact roll is 35 durometer.

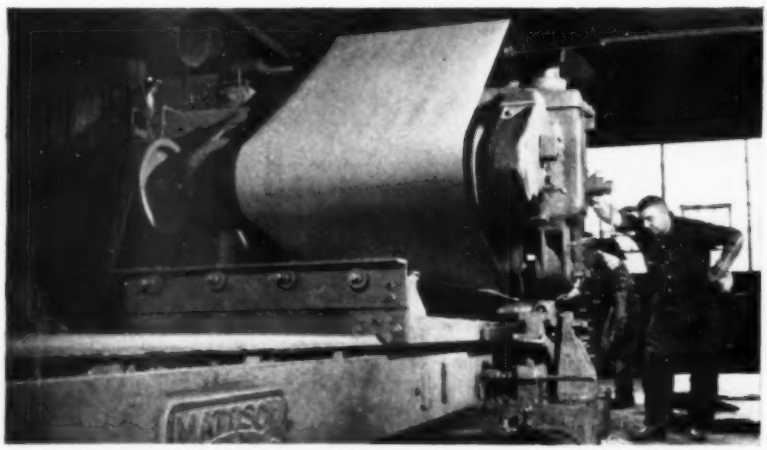


Fig. 3—Simplicity of controls means the operator can concentrate on the fine points of producing a #4 finish. Cutting speed is 3600 sfpm. Stock removal averages .003 in.

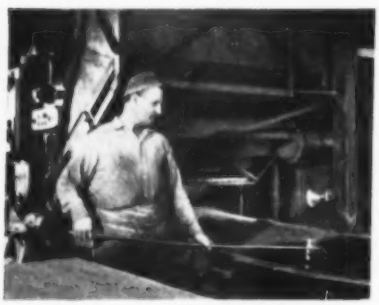


Fig. 1—General-purpose petroleum base lubricant is applied by swabbing.

Less than 2% downtime

Two Mattison No. 455 abrasive belt grinding and polishing machines are frequently used on 24-hour production schedules and yet have recorded less than 2% downtime since 1952. In the words of one Atlas official: "Performance has been failure-free with downtime restricted to scheduled maintenance once or twice a year."

MATTISON MACHINE WORKS
Rockford, Illinois Phone 2-5521

Want More Information?

Write for free literature describing the Mattison No. 455 Reciprocating Table Sheet Polisher or No. 456 Pinch Roll Grinder for single-pass work.

MATTISON MACHINE WORKS
HIGH-POWERED PRECISION SURFACE GRINDERS

Frederick A Fielder has been elected vice president and general manager of Baldwin-Lima-Hamilton's Loewy-Hydropress Division, New York. Formerly general sales manager and assistant general manager of the division, he succeeds the late **Erwin Loewy**

J J Rozner, executive vice president, has been elected president of Aetna Ball and Roller Bearing Co. He is also a vice president of the parent Parkersburg-Aetna Corp

A "Ace" Vetter has been named manager of overseas operations for the Cross Co of Detroit. He will head operations at the company's new plant in Germany

NAMES IN THE NEWS...

Robert W Ebey has been appointed general manager of the recently formed Ball Division of Hoover Ball & Bearing Co. He was formerly manager of ball sales.

N W Morelli has been appointed works manager of the Allis-Chalmers Works in Pittsburgh to succeed **D G McArn** who is planning to retire. Mr Morelli has been serving as superintendent of transformer assembly at the A-C Terre Haute Works.

Frank T Cameron has been named manufacturing manager of Ingersoll Kalamazoo Division of Borg-Warner Corp. Mr Cameron was formerly associated with Bucyrus-Erie Co as manager of the Evansville plant.

Harry B Henshel, executive vice president of Bulova Watch Co, New York, has been elected president of the company. He succeeds **John H. Ballard** who is retiring after 50 years of service with the firm.

William S Horsefield, works manager of Whitney Chain Co, recently acquired by Foote Brothers Gear & Machine Corp, has been elected a vice president of Whitney.

Dean S Fields, first vice president of McCord Corp, Chicago, has been elected president and chief executive officer of the company. He succeeds **William G Hancock** who will continue as board chairman until his retirement at the end of the year.

Walter Crafts, associate director, technology, Union Carbide Metals Co, Niagara Falls, has been named new president of the American Society for Metals. **William A Pennington,** professor of metallurgy, University of Maryland, has been named vice president of the Society.

J E Dato has been appointed sales manager, electric welding, for Linde Co, Division of Union Carbide Corp. He was previously manager, electric welding, for the eastern region.

William H Baudouine has been appointed general manager of the Abrasive Division of Elgin National Watch Co, Elgin, Ill. He moves up from the position of divisional sales manager.

Lowell C Powell has been named product manager, heat treating equipment, at Salem-Brosius, Inc, Pittsburgh.

Arthur F Loveland has been promoted from assistant works manager to works manager of the Berwick plant of American Car and Foundry Division of ACF Industries

Andrew C Bayle, director of engineering at Waltham Precision Instrument Co, Waltham, Mass, has been elected vice president, engineering

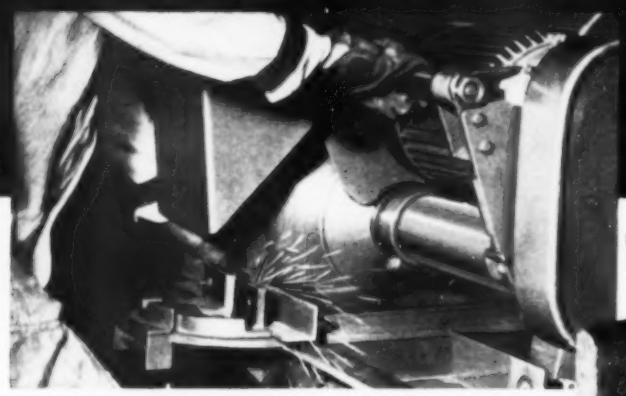
Paul C Kjelstrom, executive assistant at Verson Allsteel Press Co, Chicago, has been appointed sales manager of the Mechanical Press Division

New concept

IN LOW COST CUTTING OF STEEL

PROMACUT

multi-purpose cut-off saw



Model Uni - 8A 10 H.P.

make 10 cuts in 28 seconds

INCLUDING POSITIONING

only 1/5¢ blade cost per cut

The standard PROMACUT unit without extras does any job you're now doing by hacksaw, bandsaw, abrasive or friction cut-off . . . and does it faster, cheaper and more simply. Makes accurate straight and angle cuts, notches, outcuts and incisions—by free-hand or table cutting. Check the quality and savings in features below.

OTHER TYPICAL EXAMPLES OF MAXIMUM SPEED AT MINIMUM COST

Stock (Mild Steel)	Time, Secs. Per Thru-Cut	Min. Cuts Before Sharpening	Blade Cost Per Cut
3/4" dia. Round	0.6	2500	$.0027
3/16" Flat x 7" length	0.9	3400	.0020
2" Square Tube, 1/4" Wall	1.8	2000	.0034
4" dia. Tube, 1/8" Wall	1.2	3600	.0019
3" x 3 1/2" x 3/8" Angle	3.6	1200	.0057

- No coolants needed
- No clamping or hold-down
- Cuts smooth—practically burr-free
- Cuts all shapes of carbon, stainless and alloy steel
- Long blade life
- Cuts 4" angle, 1⅝" round, 4½" tube, 5" H

WRITE FOR DETAILS . . . ASK FOR MOBILE DEMONSTRATION AT YOUR PLANT

PMI Inc. **PRODUCTION MACHINERY** INCORPORATED

BALTIMORE • CHICAGO • LOS ANGELES • HOUSTON

P. O. Box 322, Dept. A, Oakton Station, Des Plaines, Illinois

DEALERS: Some territories still open—write on letterhead

NAMES IN THE NEWS...

Clifford H Hagberg has been appointed manager of the newly established eastern sales district of Bullard Co. He will make his headquarters in Bridgeport, Conn

Robert W Schoeffler has been named field sales manager of Marshall & Huschart Machinery Co, Chicago. He has been associated with M & H for the past ten years

OBITUARY

William H Gallmeyer, 76, president and treasurer of Gallmeyer & Livingston Co, Grand Rapids, died July 25. Mr Gallmeyer had been the third of his family to head the company, manufacturer of precision surface grinders, and tool and cutter grinders

NEW FILMS...

GUIDED MIST. *Produced by Ransburg Electro-Coating Corp, PO Box 23122, Indianapolis 23, Ind. 16 mm, sound, color. Running time 18 min.*

The story of the Ransburg No. 2 Process hand gun is depicted in interesting fashion in both the laboratory and in actual production. Its flexibility and versatility are exemplified in the painting of various products, ranging from long, outdoor lighting standards to toys, furniture, partitions, and small pieces of door hardware. Clearly shown is the mist of fine particles guided to the work by electrostatic forces.

•

DESIGN FOR POWER. *Produced by Denison Engineering Div, American Brake Shoe Co, 1160 Dublin Rd, Columbus 16, Ohio. 16 mm, sound, color. Running time 18 min.*

The advantages of axial piston pumps on heavy-duty press equipment, mobile machinery, ground support, and marine power systems, at pressures up to and above 5000 psi are analyzed in this new film.

•

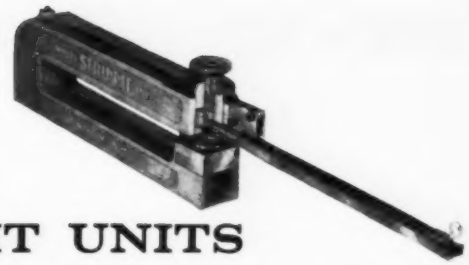
MOTORS IN THE MAKING. *Produced by Wagner Electric Corp, St Louis 33, Mo. 16 mm, sound, color. Running time 31 min. No charge.*

The film shows, step by step, the processes involved in the manufacture of electric motors, including frame fabrication, stator winding, rotor casting and winding, assembly, testing, and packing. Also shown are the testing of materials, tools, and instruments used in production. The narration is clear and factual without being highly technical.

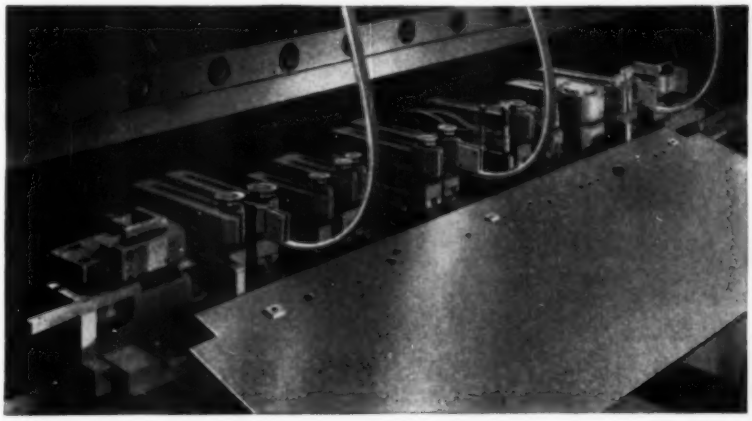
•

A PRODUCT OF THE IMAGINATION. *Produced by Aluminum Co of America, 1501 Alcoa Bldg, Pittsburgh 19, Pa. 16 mm, sound, color. Running time 26 min. No charge.*

In a unique presentation, this film tells the story of aluminum from the beginning of time to the world of tomorrow. Narrated by Adam and Eve, it shows how man's imagination and ingenuity finally unlocked aluminum metal from its natural compounds to make of it the most versatile of all elements. From mine to finished product, the film tells, in



NEW
STRIPPIT UNITS
. . . stake nuts permanently with every press stroke!



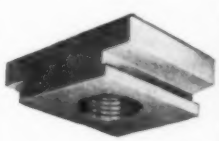
STRIPPIT PIERCE NUT UNITS save operations, time and money in assembly panel production with single-stroke insertion of Fabristeel Multipierce Nuts* into sheet metal up to .125" thick.

Permanent Fastening by an Exclusive New Process—as nut pierces stock, metal flows into nut shoulder slot, becoming an integral part of the stock.

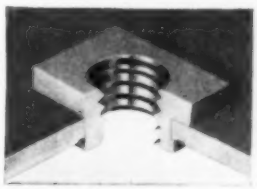
High-Speed—fast press setups, automatic feed of nuts to units for long, medium or short runs gets maximum production per press.

Flexibility—Pierce Nut Units can be quickly press-mounted in any desired pattern, changed on short notice, re-used over and over.

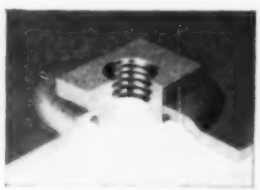
*A Product of Fabristeel Products, Inc.



Each nut is its own punch, a new one each time



Die button causes material to flow into nut slot



Simultaneous embossing for flush fastening

WRITE FOR DEMONSTRATION on your press! The speed and simplicity of Strippit Pierce Nut operation has to be seen to be believed. Also request new catalog for complete specifications.

WALES STRIPPIT INC.
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In Canada: Strippit Tool & Machine Company, Brampton, Ontario

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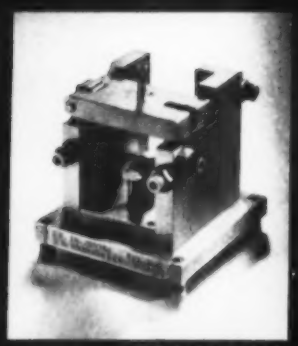
Tooling with tape...

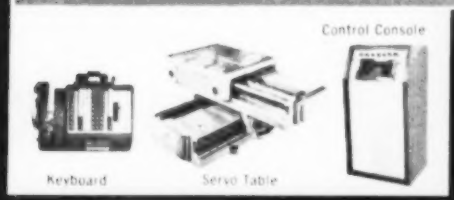


This drill jig: $280.00

This drill jig: $4.20

you can see the profit in point positioning with DIGIMATIC* model 202 Point-Positioning System

Ask us to arrange a demonstration with **your** parts.
Write for free 12-page booklet, "DIGIMATIC MODEL 202."
Also—movies shown at your shop or plant on request.



The lowest-cost complete point-positioning system for drilling, tapping, reaming, spot facing

*DIGIMATIC IS OUR TRADEMARK

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A DIVISION OF GENERAL DYNAMICS
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26 musical minutes, the aluminum industry's 70-year history in terms of processes, plants, and products, and shows how the metal can be cast, forged, rolled, drawn, extruded, and impacted. It concludes with a look into the future and shows some of the fantastic possibilities in aluminum design.

•

UNIVAC SOLID-STATE COMPUTER. *Produced by Remington Rand Div, Sperry Rand Corp, 315 Park Ave S, New York 10, NY. Color slides.*

A series of 11 color slides dealing with the Univac Solid-State electronic computer, the first of its kind commercially available in the US. The unit behaves like its large-scale predecessors, but with the advantage of lower cost, reduced maintenance and lower power requirements. The slides depict the various pieces of equipment and include a view of the installation at the Dresdner Bank, Germany, which was the first user anywhere in the world. Another slide shows the Ferractor amplifier which is the size of a pencil-tip eraser and performs accurately at from 60 below zero to 220 F above.

•

THE PRODUCTION OF URANIUM FEED MATERIALS. *Produced by US Atomic Energy Commission, Oak Ridge, Tenn. 16 mm, sound, color. No charge.*

Filmed at several AEC plants, this new picture explains the processing of uranium ore into pure uranium. Starting with the receipt of the ore concentrate, it follows the various chemical steps necessary to extract uranium and produce metallic fuel elements for nuclear reactors, as well as uranium salts from which fissionable isotope 235 is obtained.

•

POWER-UP. *Produced by Denison Engineering Div, American Brake Shoe Co, 1160 Dublin Rd, Columbus 16, Ohio, 16 mm, sound, color. Running time 12 min. No charge.*

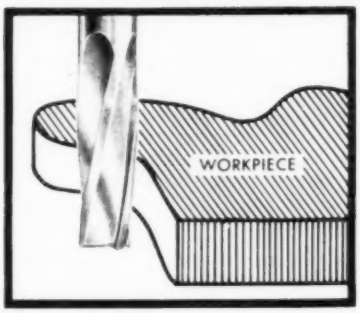
This new film shows how the power and efficiency of hydraulic circuits can be improved through the newest type of vane pumps at pressures up to 2000 psi. Applications shown are particularly interesting to hydraulic systems engineers in the field of mobile equipment, field testing devices, and automatic and semi-automatic production machinery.

Atrax

Precision Ground SOLID CARBIDE TOOLS AND BURS

Job Applications

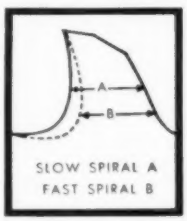
BETTER PROFILE MILLING ON 302 STAINLESS WITH 4-FLUTE, SLOW SPIRAL SOLID CARBIDE END MILL



After failure of H.S.S. End Mill, a Series 1505, 5/16" diameter "standard stock" Atrax Carbide End Mill was used. Operation performed on a Bridgeport with hand feed. Stock removal between .025"-.030" on roughing cut and between .005"-.006" on finish cut, both with same tool. Speed–2750 R.P.M.

SPECIFIC ADVANTAGES

of using this slow spiral, (approximately 15° right hand helix) Solid Carbide End Mill is the strengthened tooth form and reduced rake angle, not obtained with the regular fast spiral.



This Tool is designed and recommended especially for use on stainless steel and other

TOUGH TO MACHINE MATERIALS

stellite, titanium, nickel, chrome, monel metal and high temperature steels. Another decided advantage—this Atrax Tool can be run at slower speeds for longer tool life without injury to cutting edge.

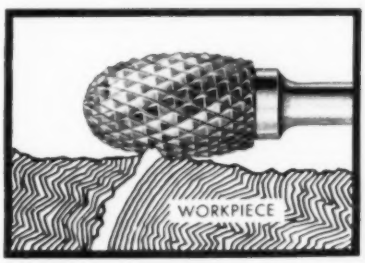
WHY USE A DIAMOND CUT BUR?

A diamond cut pattern which can be applied to a coarse, standard, or fine cut Bur is beneficial in the elimination of elongated slivers usually obtained when deburring such materials as stainless steel. In addition, the diamond cut provides greater operator control when used on hard materials, dies, molds, etc. and provides longer tool life on recommended applications.

NOTE: Speeds used with Diamond Cut Burs should be reduced by 1/3 to 1/2 the speeds of regular cut Burs.

HOW AN ATRAX E-161 BUR WITH DIAMOND CUT WAS USED

Hand operated at 8000 to 12000 R.P.M., using a portable air grinder, an Atrax Oval Type Bur was used to remove flashing from nodular iron castings.



Previously a H.S.S. Bur had been used with a tool life of 8 hours. The Atrax E-161 was removed for resharpening after 48 operating hours.

COSTS LESS 3 WAYS

Tool cost was $.06 per hour less with the Carbide Bur. The Carbide Bur also removed excess flashing from each casting faster with better surface finish and less operator fatigue. Atrax Oval Shape Burs are available from stock in Standard, Coarse, Fine and Chip Breaker types at no increase in cost.

WHAT IS A BUR WITH CHIP BREAKER CUT?

A chip breaker is a break in the continuity of the cutting edge which interrupts the cutting action, thereby breaking the chip into small sections and allowing improved tool control. Chip Breaker can be furnished on all Atrax Burs, on request, at no extra charge.

The job applications outlined here are taken from actual customer production experiences. We feel that this information can help you improve production, lower costs, and discover the superiority of Atrax Solid Carbide Tools and Burs.

SEND FOR 148 PAGE "STANDARD REFERENCE" ON SOLID CARBIDE TOOLS . . .

TO: THE ATRAX COMPANY
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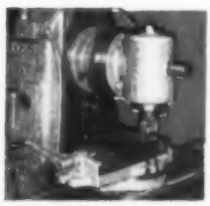
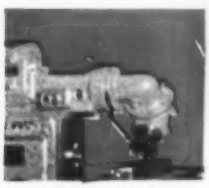


Heavy Duty Vertical Milling Attachment

Heavy Duty Offset Vertical Milling Attachment

Universal Milling Attachment



Toolmakers Overarm

Heavy duty attachments increase versatility of dependable, low-cost

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BY INCHWORM!

The INCHWORM™ Motor brings an entirely new concept of precision and closer tolerances to the machine tool industry.

Many leading producers of precision machined parts have replaced centerless grinder lead screws with INCHWORMS to achieve:

- **tolerances to ± .000025"**
- **elimination of *backlash***
- **lower production costs**

The INCHWORM Motor works on the principle of magnetostriction, enabling the machine tool operator to advance or retract the tool in microscopic increments by simply pushing a button. An easily read dial gives him control, with 50 times the accuracy possible with a conventional lead screw. And, he doesn't have to take time to retract the lead screw and slowly advance it again—he gets final size simply by pushing the button.

AT NO EXPENSE TO YOU . . .

The INCHWORM Motor can be installed on your centerless grinder in less than an hour—and prove itself almost immediately. We will install it in your plant, *on approval*, upon the recommendation of our sales engineer.

Send for the complete story!

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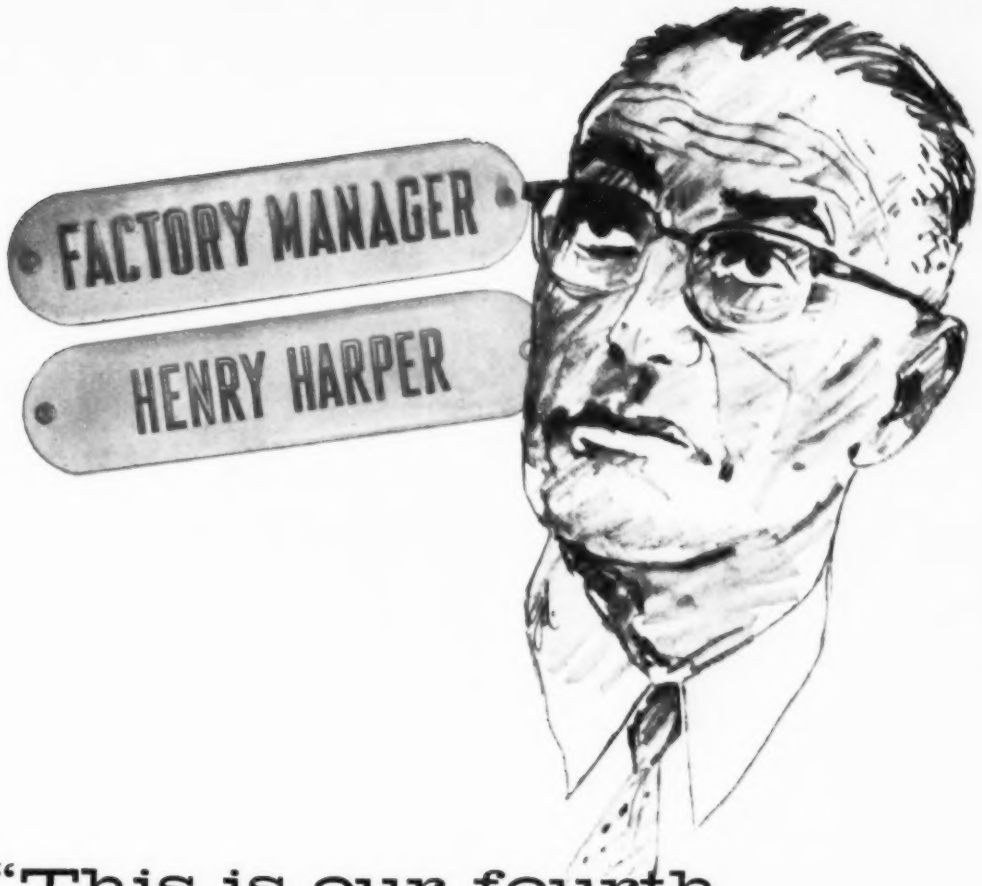
1345 NEW YORK AVENUE
HUNTINGTON STATION, L. I., N. Y.
A DIVISION OF CUTLER-HAMMER, INC.



"This is our fourth plant expansion"

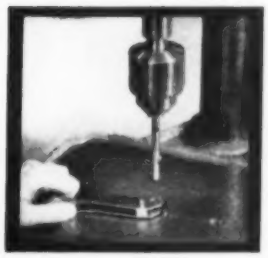
"When I joined the company in 1935, the whole plant was in the building where Inspection and Shipping are now. Production was handled like single jobs. But new equipment has changed all that. Now, with only three times as many men, we're turning out 10 times the volume we did in '35. And we're still growing."

This kind of seam-bursting growth has made Metalworking a $120 billion industry; has made its production management vitally important. For these men supervise, plan and boss manufacturing in a dynamic field. While hypothetical, Mr. Harper is representative of production engineers and executives in Metalworking—your best customers.

American Machinist is the magazine that helps these men look ahead; helps them keep current in a fast-moving technical field. Expertly edited by experienced engineers, it's an advanced text for younger men, a sure way to keep up for the veterans. Thus, throughout Metalworking, you'll hear production men say . . .

"I have to read American Machinist,,

McGraw-Hill Magazine of Metalworking Production
330 West 42nd Street, New York 36, New York



DEBURRING COSTS CUT 2/3 ON THIS PART!

Spring-loaded Burraway blade chamfers top edges on down-stroke, depresses to pass through stock.

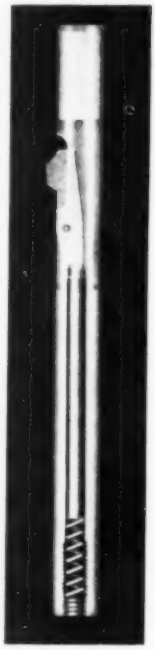
On up-stroke, Burraway blade chamfers under edges. Four edges in just one pass!

One pass of the Cogsdill Burraway tool chamfers four hole edges on this stamped handle. The job previously required four separate passes—two with a right-angle chamfer, two with a standard tool.

Burraway's spring-loaded blade adjusts for light deburring or up to ⅛" chamfer. On down-stroke, just enough pressure exerts to catch the edge; the blade then depresses to pass through the stock. On up-stroke, the under-edge is similarly chamfered.

Burraway works in any head, on automatics or multiple-spindle machines to eliminate many hand or secondary operations. Its costs are often returned the first day. If you debur or chamfer, you need Burraway.

FOR THE ASKING—Complete Cogsdill catalog on Burraway, Baksink, Bearingizing and other time-saving tooling.



Cogsdill

TOOL PRODUCTS, INC.

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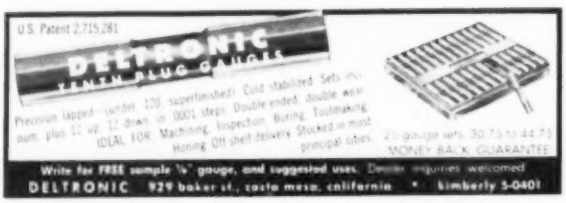
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Low cost automatic

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Compare the cost and features of these new RCA Automatic Rotary Hoppers, and you'll see why they are gaining such rapid acceptance! They provide every needed operating feature, yet are offered at remarkably low prices . . . beginning at $265, f.o.b., Detroit.

Features:

- **High-speed—up to 20,000 parts per hour.**
- **Handles cylindrical, rectangular, headed disc shaped and other parts.**
- **Parts orientation performed by feed track, not the bowl.**
- **Feed tracks easily changed by loosening one screw.**
- **18", 24", 30" bowls available.**
- **Rugged construction—cast-iron frame; driving mechanism supported by heavy duty self-aligning bearings.**
- **Standard gear-head motor.**
- **Safety-slip drive protects parts and equipment.**
- **Price includes cleats on selector ring and mounting block for tracks.**
- **Demand-control mechanism and wide variety of discharge tracks furnished at modest extra cost.**

Write today for complete information on low-cost RCA Rotary Hoppers. To permit analysis of your needs, send two samples of each part to be handled, and indicate required production rates. Details of other RCA Automation Equipment available on request.

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CIRCLE 267 READER SERVICE CARD

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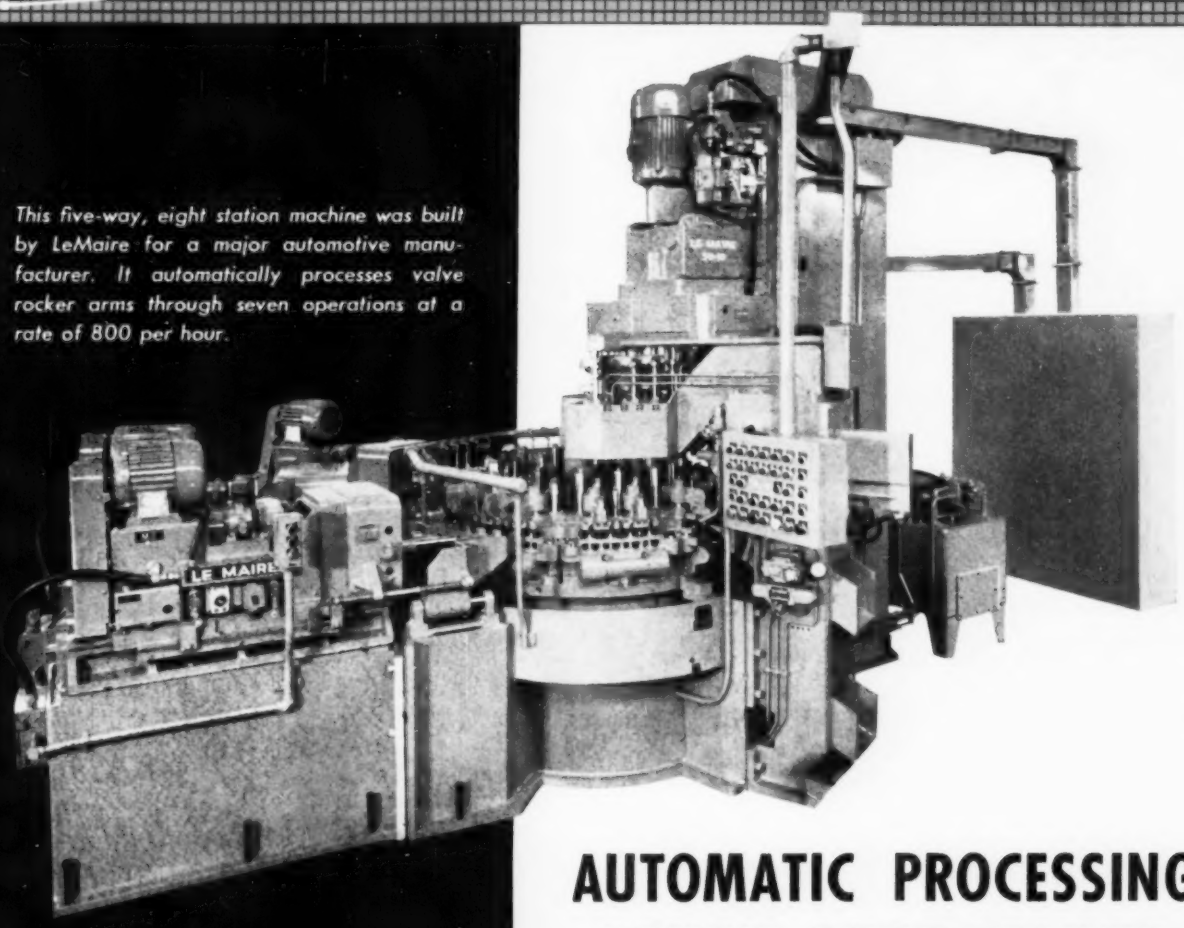
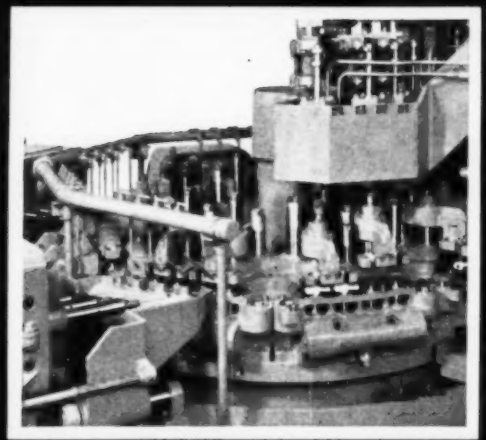
CIRCLE 269 READER SERVICE CARD ▶

PRODUCING with LE MAIRE

This five-way, eight station machine was built by LeMaire for a major automotive manufacturer. It automatically processes valve rocker arms through seven operations at a rate of 800 per hour.





Here's a close-up of the automatic hydraulic indexing table. Work-holding fixtures have pilot bushings that register with sliding bushing plate for positive alignment.

AUTOMATIC PROCESSING

SEVEN OPERATIONS
800 PARTS PER HOUR

The variety of operations and efficiency of this machine clearly demonstrate the versatility of application inherent in LeMaire hydraulic, self-contained way-type power units. They are mounted on this machine in horizontal, vertical and angular positions to perform seven different operations. Here's the eight-station sequence of automatic operations:

(1) Manually load four valve rocker arms
(2) Drill .094" diameter hole at 30° angle
(3) Drill 25/64" diameter hole
(4) Countersink .469" diameter and spot face 7/8" diameter
(5) Tap 7/16"-20 American National Thread
(6) Chamfer .7925" hole
(7) Finish ream .7925"/.7935" hole
(8) Automatically unload and wash fixture

LeMaire engineers specialize in solving production problems—give us a call or write.

LE MAIRE MACHINE TOOL COMPANY

2657 S. TELEGRAPH ROAD
DEARBORN, MICHIGAN

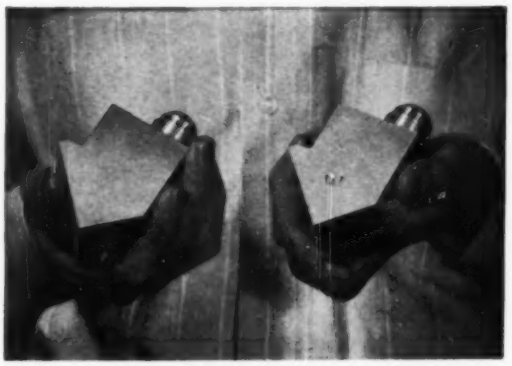
Designers and Builders of Special High-Production Machines

Practical Tooling Tips

NUMBER 1 OF A SERIES

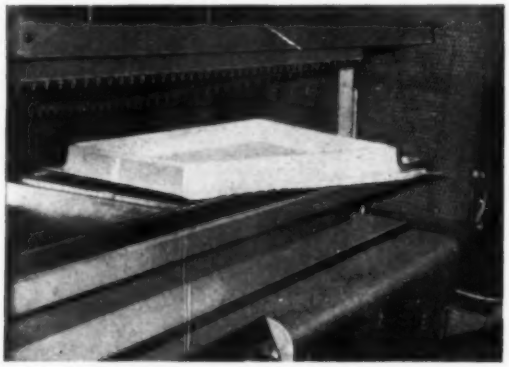
Everyday more and more shops are using standard Vlier Tooling Accessories in place of custom-made devices for both tooling and original equipment applications. The precision construction, product uniformity and quick availability of these simple time-savers have made them tool room favorites. Why don't you start saving from their use?

TO GET GREATER TOOL BIT RIGIDITY replace the tool holder screw with a Vlier Swivel-Pad© Clamp. The large, flat pad face provides many times more clamping area. Bits can be held tighter, reducing chatter and vibration. Small, narrow cut-off blades, multipoint tools, even stub ends can be rigidly held. Unique ball joint construction gives smooth angle adjustment in all directions.



EASY WAY TO STOP MARRING surface of part held in fixture. The part on the left was securely held in the fixture with a Vlier Swivel-Pad© Clamp. The scrapped part on the right was held with an ordinary set screw. With the Vlier Swivel-Pad© Clamp the pad stops at first contact with the part; screw torque is absorbed by a ball, preventing damage to the part. This exclusive ball joint construction also provides adjustment to off-angle surfaces.

SPRING PLUNGERS LET WRENCH DO MULTIPLE DUTY—The compression tool shown above is used to attach connectors to electrical wires. Formerly, each size wire connector required a different size tool. But now, through the use of Vlier Spring Plungers, one tool attaches all sizes of connectors—through the use of changeable jaws. The appropriate jaw for any size connector is easily inserted, accurately positioned, and held in place with a Vlier Spring Plunger.



THE RIGHT AMOUNT OF END PRESSURE AND NO MORE is what this spring plunger application calls for. More than 150 Vlier Spring Plungers are used to hold a plastic sheet in position during the forming operation of a plastic refrigerator door liner. Spring Plungers provide just the right amount of pressure to produce a perfect liner. .

New catalog now ready! Send for your copy today.

Insist on Vlier Tooling Specialties... there's still no substitute for quality.

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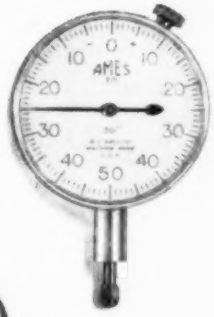

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For desk, bench or at-the-machine inspection of small parts.

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For more than half a century, Ames measuring instruments have been regarded as the finest made. Today the constantly growing line of Ames indicators, gauges, micrometers and comparators includes such amazingly accurate instruments as the new Ames "PORTA-CHECK", an electronic comparator which gives accurate readings *in millionths of an inch*; and the new Model AG air gauge—also accurate to millionths of an inch. Wherever precision is *really* important . . . you'll find Ames "masters of measurement" on the job.

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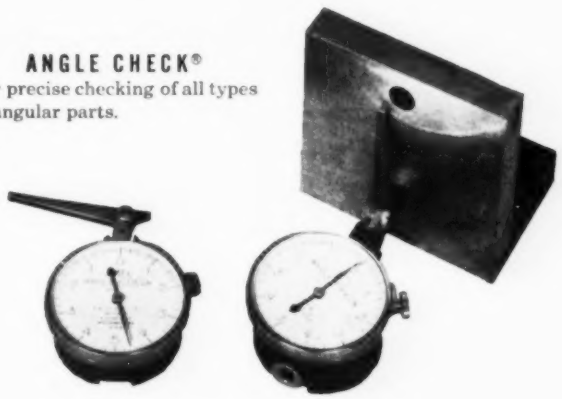

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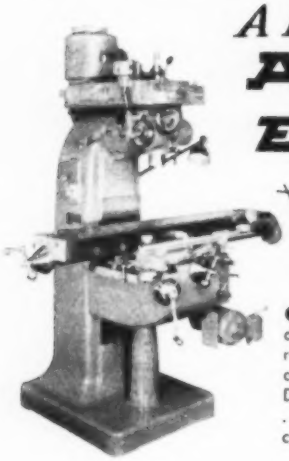

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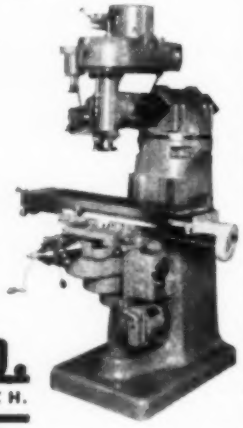

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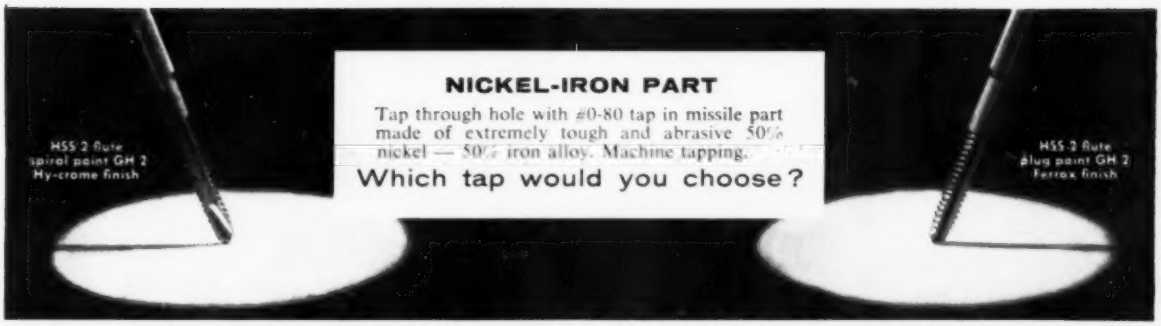
HSS 2 flute spiral point GH 2 Hy-crome finish
NICKEL-IRON PART
Tap through hole with #0-80 tap in missile part made of extremely tough and abrasive 50% nickel — 50% iron alloy. Machine tapping.
Which tap would you choose?
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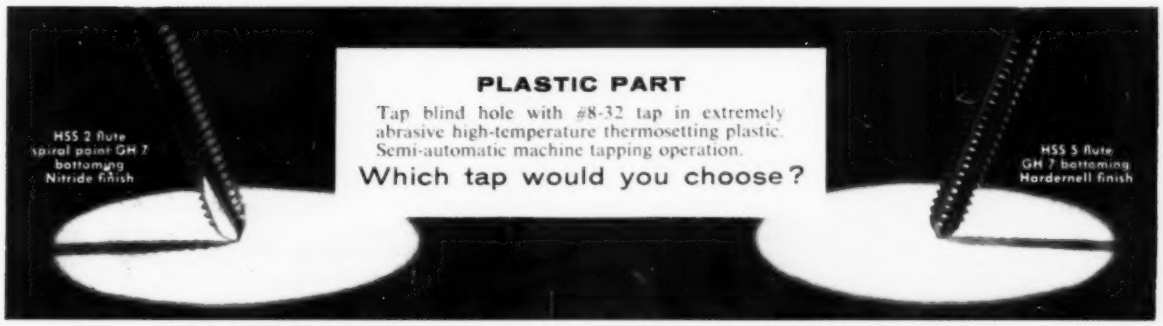
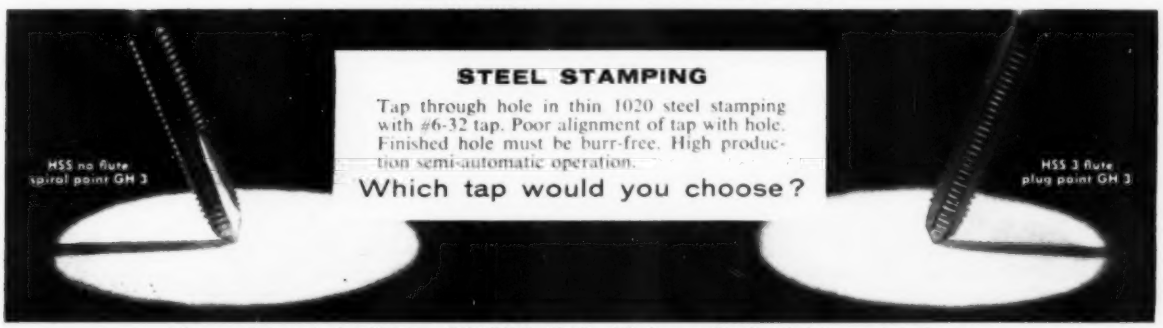
The HY-PRO #311 tap with Hy-crome finish (left) produced *5.7 times* the number of holes per tap obtained with the 2 flute plug tap.


HSS 2 flute spiral point GH 7 bottoming Nitride finish
PLASTIC PART
Tap blind hole with #8-32 tap in extremely abrasive high-temperature thermosetting plastic. Semi-automatic machine tapping operation.
Which tap would you choose?
HSS 5 flute GH 7 bottoming Hardernell finish

The HY-PRO #510-5 tap with Hardernell finish (right) produced *11.3 times* the number of holes per tap obtained with the 2 flute spiral point tap.


HSS no flute spiral point GH 3
STEEL STAMPING
Tap through hole in thin 1020 steel stamping with #6-32 tap. Poor alignment of tap with hole. Finished hole must be burr-free. High production semi-automatic operation.
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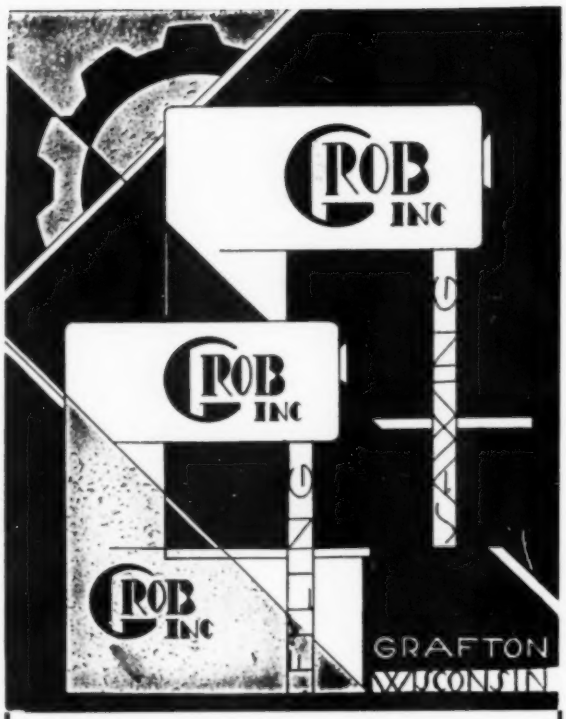

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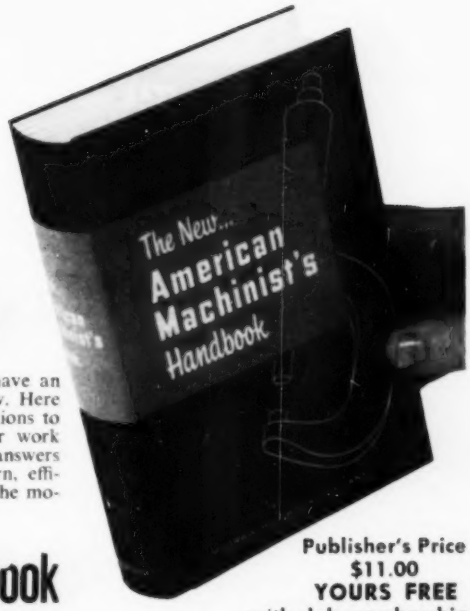

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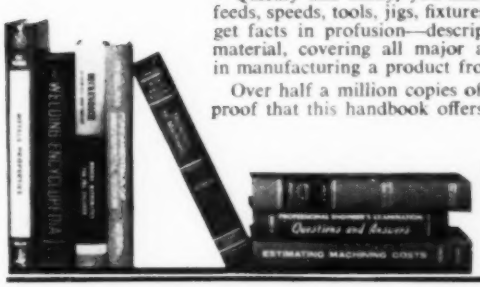

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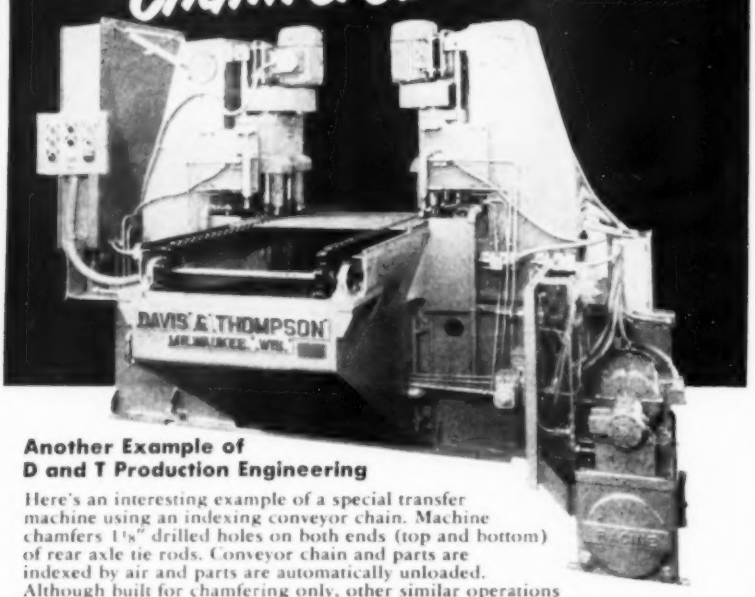

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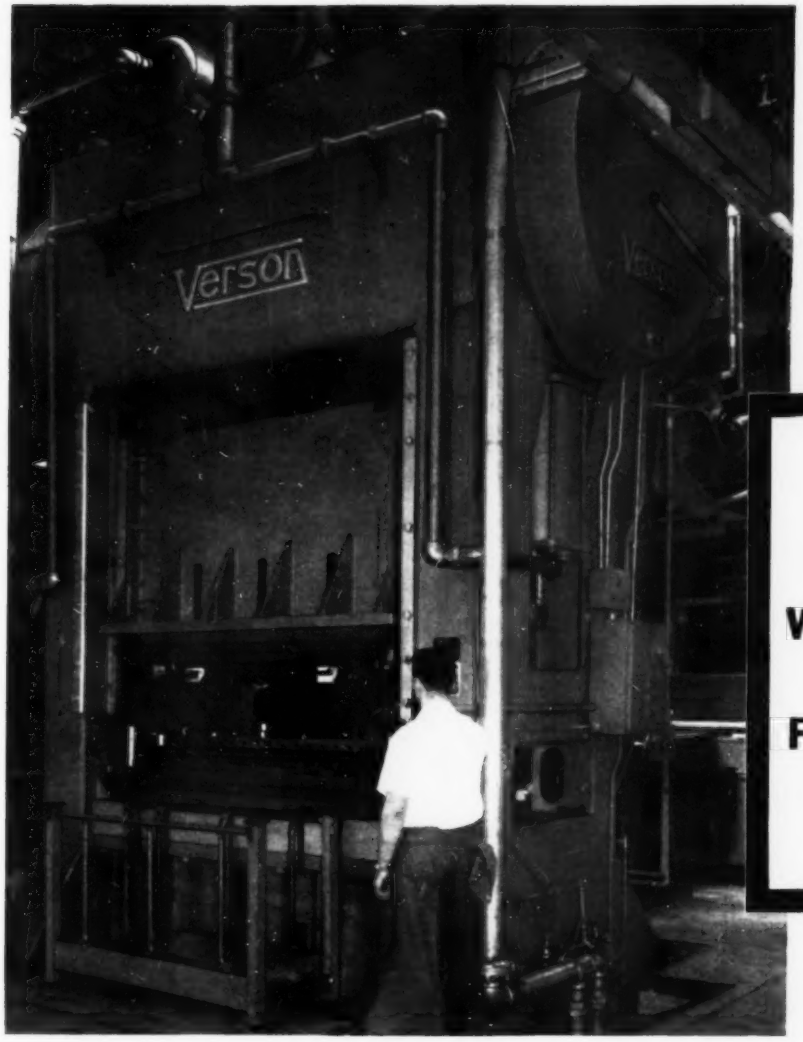

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All with 2" 1500 RPM. Spdle.

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The numbers after the advertiser's name, indicates the products or services offered by the advertiser.

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6. Boring Mills
7. Broaching Machines
12. Cranes
15. Die Sinking Machinery
16. Drilling & Reaming Machines
18. Engraving Machines
23. Gear Cutting Machines
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8/24/59

Cimco

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#2 Cincinnati Dial Type High Speed Vertical Mill, powerfeed to head, late type.
#4 Cincinnati HI Speed Dial Type Plain Mill, table 78½" x 18½", 16 speeds to 1300 RPM.
3" bar Giddings & Lewis, 2" auxiliary bar, high speed, late type.
30" x 29' oc LeBlond Hv. Duty G. H. Lathe, late type, 2 carriages, tapers, swings 84½", 16 speeds.
12" Morey Vert. Slotter AC motor drive, 24" rotary table, latest type.
14' x 12' x 89' Betts Double Housing Planer, 50 HP DC motor, 4 heads, box table. ACTUAL PHOTOGRAPH AVAILABLE.
#4 Cincinnati Dial Type Universal Mill, medium speed, late type.
18" x 40" x 96" centers Norton Type "C" Cylindrical Grinder, two gaps, swing 48" and 28" in gaps, mechanical feed, late type.
20" Gould & Eberhardt Industrial Shaper, vise, front support, new 1947.
22" x 24' centers Monarch Model CM Geared Head Lathe, actual swing 27½", 16 speeds, two Carriages, tapers.
14" x 96" centers Bogs & Emmes G.H. Lathe, 12 speeds, timken, late taper.
45T Giddings & Lewis table type boring mill, table 40 x 48, outer support, late type.

Cincinnati Machinery COMPANY

3901 Kellogg Ave., Cincinnati 26, Ohio
Phone TRinity 1-0853
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Deckel Universal Pantograph Die Sinking Machine Type KF-12 with extra equipment. New 1956.

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eastern Rebuilt Machine Tools

THE SIGN OF QUALITY — THE MARK OF DEPENDABILITY

GEAR SHAPERS
W. C. Lipe Gear Chamfering, m.d.
Type Z Fellows Horizontal, m.d.
No. 4 Fellows Enveloping Gear Generator, m.d.
No. 12 Fellows Gear Shaving Machine, m.d., late
No. 7 Fellows, 1945
No. 7, 7A Fellows Gear Shapers, belted m.d.
No. 18 Fellows Gear Fininshing Machine, m.d.
No. 61A Fellows, m.d., latest type, 1945
No. 645A3 Fellows, vee belt drive
No. 645Y Fellows, m.d.
No. 70 Cross Deburring Machine, m.d., 1940
No. 72 Fellows H.S. Spur Gear Shaper, m.d.
No. 73 Fellows, H.S., m.d.
No. 75A Fellows H.S. Spur & Helical, m.d.
No. 712 Fellows, m.d.
No. 7125A Fellows, m.d., H.S.
No. 725 Fellows, 1945

GEAR CUTTERS
No. 7125A Fellows H.S., m.d.
No. 12 Gleason Straight Tooth Bevel Gear Rougher, m.d.
No. 36 Gould & Eberhardt Bevel & Spur Gear Rougher, m.d.
No. 4B Fellows Gear Burnisher
No. 8B Fellows Gear Burnisher
3" Gleason Gear Generator, m.d.
48" Gleason Automatic Bevel Gear Planer, m.d.
No. 5AC Lees-Bradner Heavy Type Gear Generator, m.d.
No. 4—48" Brown & Sharpe, m.d.
No. 50 Cross Clutch Miller, m.d.
No. 5—60" Brown & Sharpe Gear Cutter, m.d.

GEAR HOBBING MACHINES
No. 3 Barber-Colman, m.d.
Type A Barber-Colman, m.d.
Type S Barber-Colman, m.d.
Type T Barber-Colman, m.d., 1942
No. 1 Lees-Bradner Universal, m.d.
No. 12 Barber-Colman, double overarm, m.d.
No. 12 Barber-Colman, single overarm, m.d.
No. 34 Brown & Sharpe, m.d., spur & spiral
No. 130 Cleveland Vertical Rigid Hobber
No. 12H Gould & Eberhardt Universal Mfg. Gear Hobber, m.d.

GEAR TESTERS
FPV-60 Mang Gear Wheel Co. Profile Testing In.
12" National Broach & Machine Co.
18" National Broach & Machine Co.
18" Gleason Bevel Gear Tester, m.d.
No. 471 Michigan Tool Co. Hob, Reamer & Gear Checker
National Broach & Machine Co. "Red Ring" Universal Gear Checker

AUTOMOTIVE GRINDERS
No. 76 Van Norman Automatic Piston Turning & Grinding Machine, m.d.
Kwik-Way Model H Piston Turning & Grinding Machine, m.d.

CENTERLESS GRINDERS
No. 2 Cincinnati, m.d.
No. 3 Cincinnati, m.d.

CRANKSHAFT GRINDERS
18x66" Landis Universal Type C, m.d., late
22x72" Landis Type CH, m.d., late

CYLINDER GRINDERS
No. 50 Heald, m.d., 1943
No. 73 Heald Airplane Cylinder, m.d., new
No. 78 Heald Centerless Cylinder, m.d.

EMERY GRINDERS
48" Double End U.S. Electrical Co. Buffer
No. 5D Gardner H.D. Polishing Stand, 1948

DISC GRINDERS
Type 36FAS Model 102 Standard Elec. Tool Co. Pedestal Grinder, new
Type 10 BAP Model 100, Standard Elec. Tool Co. Pedestal Grinder, new
Type 24 FAS Model 101, Standard Elec. Tool Co. Pedestal Grinder, new
No. 186—36" cap. Gardner, m.d., latest
No. 121 Hanchett Prod. Face Grinder m.d.

SURFACE GRINDERS
No. 2B Brown & Sharpe Horizontal Wheel, 1943
No. 16 Blanchard Rotary, m.d.
No. 16A-2 Blanchard Auto-Rotary, m.d.
No. 33 Abrasive, m.d.

THE EASTERN MACHINERY COMPANY
1004 Tennessee Avenue, Cincinnati 29, Ohio
MElrose 1-1241
CABLE ADDRESS EMCO

CIRCLE 506 READER SERVICE CARD

OVERHEAD ELECTRIC CRANES

Floor Operated, 230 Volts

Quan.	Cap.	Span	Make
2	3-ton	19'	Shep. Niles
6	2-ton	19'	Shep. Niles
2	2-ton	15'9"	Shep. Niles
3	2-ton	18'9"	Cameron
1	1½-ton	19'	Detroit H & M

Cab Operated, 230 Volts DC

Quan.	Cap.	Span	Make	Beam
1	50	53'3"	Shaw	Fish
1	15	100'	Shaw	Fish
2	10	84'	Calumet	Fish
2	10	68'	Whiting	Fish
2	5	72'3"	Shaw	Box

Outdoor Crane and Runway

Runway 634' long supported by self-standing "A" frames. Now used with 15-ton crane on 100' span. Available with or without crane.

Hoists

Quan.	Cap.	Make	Type	Elect.	Lift Speed
8	⅝-ton	Yale	Cable	230 DC	58 FPM
4	1-ton	H & M	Cable	220/440 AC	10 FPM
6	1-ton	Shaw	Chain	230 DC	
8	1-ton	Yale	Chain	230 DC	40 FPM
1	2½-ton	P & H	Cable	440 AC	
2	3-ton	Yale	Cable	230 DC	20 FPM
1	10-ton	Shep	Cable	230 DC	top riding bridge

CHARLES LAURANCE, INC.
P.O. Box 689 • Weehawken, N.J.

CIRCLE 507 READER SERVICE CARD

MACHINE TOOLS FOR SALE — FROM STOCK

RBG = Rebuilt & guaranteed
RCG = Reconditioned & guaranteed

AUTOMATIC
1¼" Warner & Swasey 6 Spdl. (1956) $25,000
5"—4 Spdl Conomatic w/hrdg. HS Drills #5550KE

DUPLEX BROACH
3 ton—42" Cinci., Vert. Hydro (1950) (RBG) $8,500

GRINDERS
#109 Sheffield, Annular Form Crushtrue-Dresser '54
109 Bryant Int. New Spdl. (1947) RBG $8,950
6x18" Norton Hydraulic 1953 (RCG) $1,850

MULT. DRILL
B2B—Natco 24 Adj. Spdl Tapping (1942) $6,950
G-6 Natco 24 Adj. Spdl., Tapping (1943) $4,450

ROTARY SURFACE GRINDER
16A2 Blanchard 2 Spdl. Autom. Sz'g (1948) $5,500

TURRET LATHES
16" EC Warner & Swasey Electrocycle 1949 $3,500
#3 Gisholt, Barfeed, 1948 $4,950
#5 Warner Swasey, 2½" Bar Feed RBG $5,450
1L—Gisholt, Barfeed etc. late—good $4,950
8A J&L Barfeed, R. Traverse '45 RCG $6,950

MILLS
2H K & T Horiz. V. Head, Slotter, R. Table, Div. Head Recond. $5,950
#12 G&S "Electro" 36" Travel '43 RCG $2,450
12-48 K&T 48" Pred. 1000 RPM RBG $8,750
34-48 Cinc Hydrom R&F Tracer RCG $5,750
#33—1448 Sundstrand 14x72 Tbl. 600 RPM (1944) $7,450

MULTIMATIC
16"—8 Spdl. Bullard "D" Dbl Index RCG $17,500

PRESS
300 Ton Verson Hydr. 44x60 Bed, 28" Str. 125 HP

GEAR SHARPENER
#13 Gleason Spiral Bev. Hypoid New Cond.

All Machines Carry Regular 30 Day Return Privilege Guarantee

"MIDWESTERN"
336 Midland Bank Building
Minneapolis 1, Minnesota

CIRCLE 508 READER SERVICE CARD

LATE TYPE GISHOLT 2L cross sliding turret hardened ways; EX-CELL-O 83 Thread Grinder, HEALD 75-A Internal Grinder; IMPERIA Universal Grinder; ROTO-CLONE type D6 Dynamic Precipitor, (new), K.O. Grinder; HAMMOND No. 6 Double and Disc Grinder, 10 h.p., 18" Wheels; TAFT PIERCE 8"x36" Bench Grinders.

HERB POE MACHINERY CO.
24396 W. Seven Mile, Detroit 19, Mich.
KE 3-7888

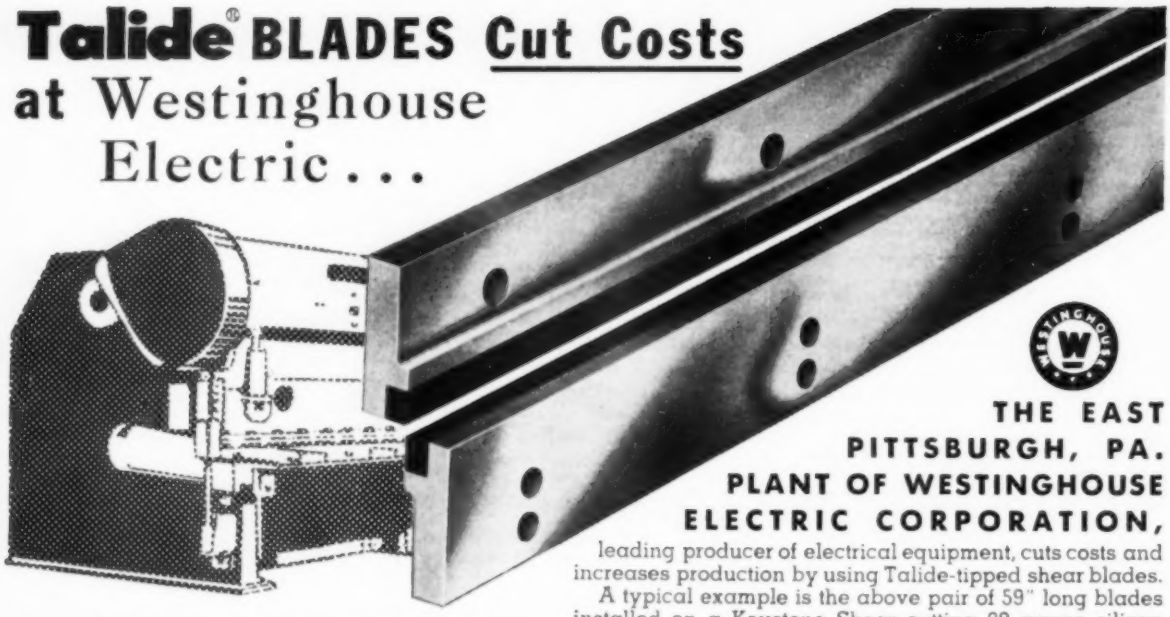
CIRCLE 509 READER SERVICE CARD

OVER 1,000 NEW AND USED MACHINE TOOLS IN STOCK
WRITE FOR LATEST STOCK LIST

MILES MACHINERY COMPANY
2039 EAST GENESEE • SAGINAW, MICH. PL 2-3105

CIRCLE 510 READER SERVICE CARD

Talide® BLADES Cut Costs at Westinghouse Electric . . .



THE EAST PITTSBURGH, PA. PLANT OF WESTINGHOUSE ELECTRIC CORPORATION,

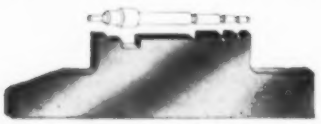
leading producer of electrical equipment, cuts costs and increases production by using Talide-tipped shear blades.

A typical example is the above pair of 59" long blades installed on a Keystone Shear cutting 29 gauge silicon steel up to 36" wide. Cutting continuously for periods up to 8 months without a regrind, approximately 5,631,000 strokes are performed at an average speed of 30 strokes per minute. 3,660 tons of metal are cut per regrind at a savings of over $2,000 alone in grinding and set-up time.

During this same period it was previously necessary to grind high-carbon, high-chrome blades 24 times — and make frequent replacement. Talide blades normally stay on the job for several years giving high-speed, continuous, burr-free production.

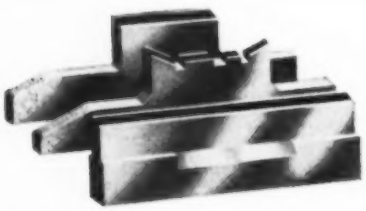
Talide blades are available in lengths up to 120" tipped with a **one-piece** carbide wear strip. There are no section or seam marks to score or scratch the metal being sheared or centerless ground. Users prefer blades of this superior construction.

CENTERLESS BLADES



LARGE ELECTRIC MOTOR PLANT

Part..... Stainless steel rotor shaft for electric motor.
Operation... Grind 7 diameters simultaneously.
Machine .... No. 12 Landis Centerless Grinder.
Blade..... Special multiple step Talide-tipped work support blade No. C-4884.
Results..... Talide-tipped blade in continuous production for 91 days (2 turns per day) compared to best previous production run of 3 days with hard alloy steel blade.



Over 50 sizes and styles of standard Talide-tipped blades carried in stock for Landis, Cincinnati and Van Norman Centerless Grinders. Special blades made promptly to order.

TALIDE ROTARY KNIVES GIVE PHENOMENAL RUN OF 90-1 . . .

A leading strip steel producer of razor blade, high-carbon, spring and stainless steel reports over 1200 coils were gang slitted with Talide knives, compared to 15 coils with steel knives. More tonnage was produced in one regrind of the Talide knives than over the entire life of a set of steel knives. Burr-free, clean-cut edges produced with scrap rate practically eliminated.

EXCLUSIVE RETIPPING SERVICE

Because of its exclusive hot press method, Metal Carbides is able to rework worn, chipped-out or broken areas of carbide-tipped blades back to original size and dimension with all breaks and defects eliminated.

METAL CARBIDES CORPORATION
TALIDE®
YOUNGSTOWN 12, OHIO
HOT PRESSED AND SINTERED CARBIDES • VACUUM METALS
HEAVY METAL • ALUMINUM OXIDE • HI-TEMP. ALLOYS
OVER 25 YEARS' EXPERIENCE IN TUNGSTEN CARBIDE METALLURGY

Ask for a Talide Sales Engineer to call— or write for 76-page 56-G catalog.

METAL CARBIDES CORPORATION
Youngstown 12, Ohio

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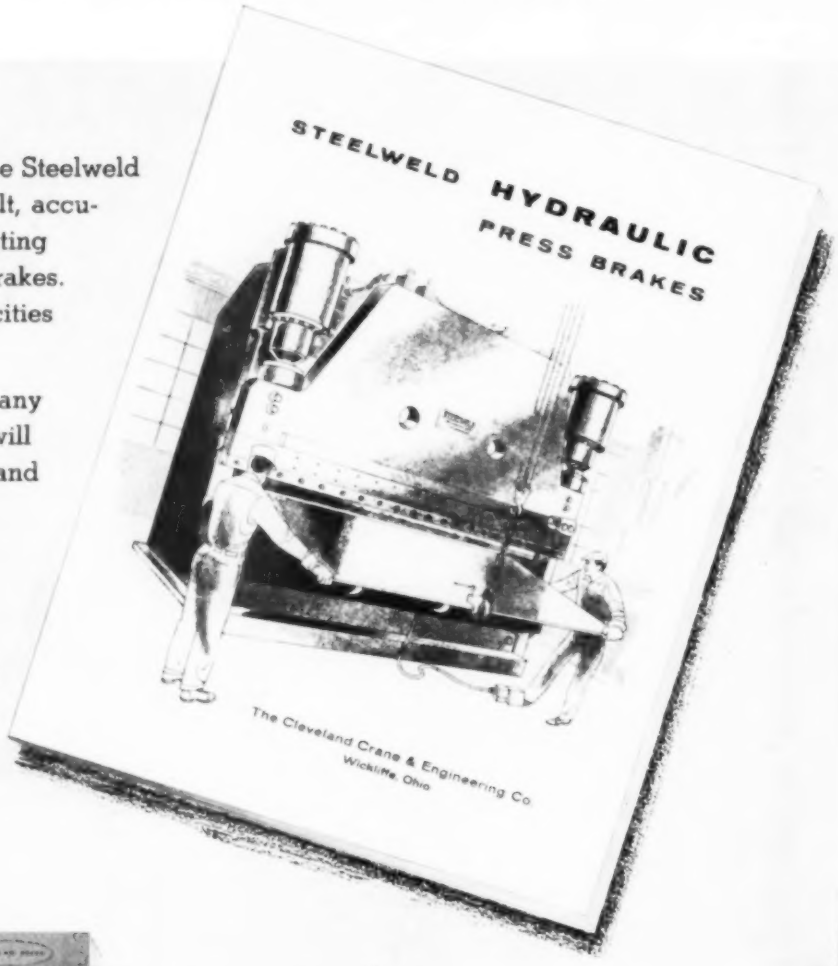

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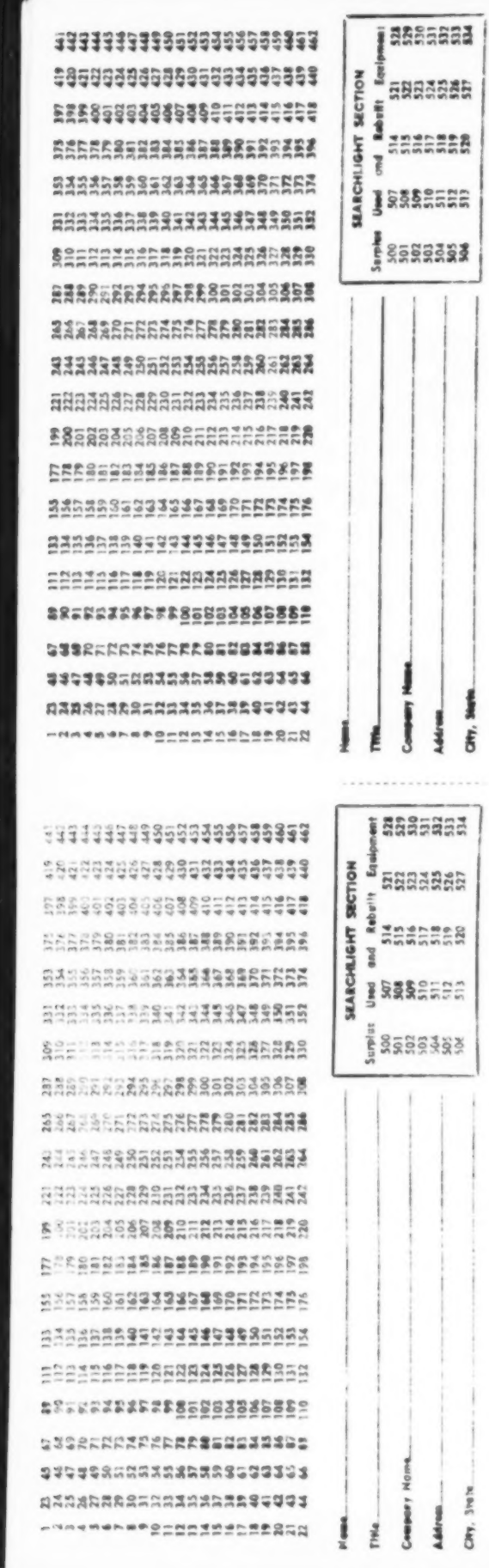

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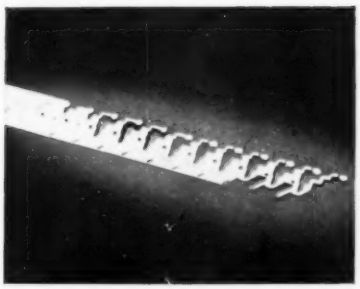

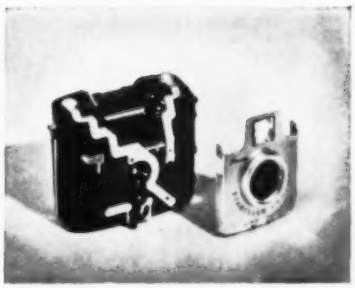

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ILLUSTRATED ABOVE: The popular Kodak Brownie Starflash Camera . . . **LEFT TO RIGHT**: Successive stages in the production of Brownie Starflash Battery Connectors as stamped by U. S. Model #33 Multi-Slide . . . Brownie Starflash Camera disassembled, built-in flash removed, to show location of battery connector produced on a #33 U. S. Multi-Slide, part of flash synchronization circuitry . . . U. S. Multi-Slide Model #33 in use at Eastman Kodak Company's Apparatus & Optical Division in Rochester, New York . . . Machine is turning out battery connectors for the Brownie Starflash Camera.

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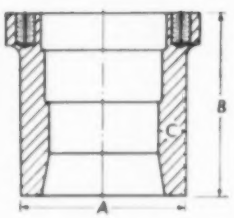

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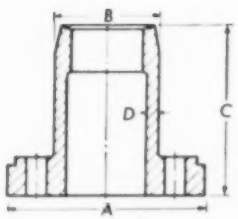

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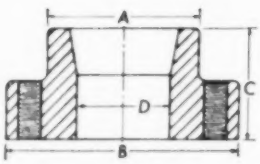

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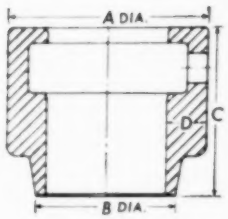

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